

VOLUME I

NUMBER 1

JANUARY, 1914

THE MINERAL RESOURCES OF OREGON

Published Monthly By

The Oregon Bureau of Mines and Geology



Rainbow Mine—Mormon Basin, Eastern Oregon.

TABLE OF CONTENTS

	Page.
Announcement	3
Estimate of Oregon's Mineral Production for the Year 1913	4
Mineral Survey a Necessity	7
Survey Methods	8
Activities of the Oregon Bureau of Mines and Geology	11
What Is the Matter With the Mining Industry?	A. M. Swartley 18
The Occurrence of Coal in Squaw Creek Basin	Ira A. Williams 28
Something Ever New in Coal Annals	Ira A. Williams 49
The Law Which Created the Oregon Bureau of Mines and Geology	58

**OREGON
BUREAU OF MINES AND GEOLOGY
COMMISSION**

OFFICE OF THE COMMISSION
526 YEON BUILDING, PORTLAND, OREGON

OFFICE OF THE DIRECTOR
CORVALLIS, OREGON

Oswald West, Governor

COMMISSION

H. N. LAWRIE, Portland
W. C. FELLOWS, Whitney
J. F. REDDY, Medford
C. T. PRALL, Ontario
T. S. MANN, Portland
P. L. CAMPBELL, Eugene
W. J. KERN, Corvallis

STAFF

HENRY M. PARKS, Director
ARTHUR M. SWARTLEY, Mining Eng'r
IRA A. WILLIAMS, Ceramist
SIDNEY W. FRENCH, Metallurgist

FIELD PARTY CHIEFS

A. N. WINCHELL
U. S. GRANT
A. J. COLLIER
SOLON SHEDD
GEORGE D. LOUDERBACK

VOLUME I

NUMBER 1

JANUARY, 1914

THE MINERAL RESOURCES OF OREGON

*A Periodical Devoted to the Development
of all her Minerals*

PUBLISHED MONTHLY AT CORVALLIS BY
THE OREGON BUREAU OF MINES AND GEOLOGY
H. M. PARKS, Director

ANNOUNCEMENT.

It is the usual practice of State Geological Surveys to publish the results of their investigations in voluminous annual reports or else in bulletin form, each bulletin dealing with a special subject of investigation. These are usually the only mediums through which the people are informed of the progress and results of the work done. The Oregon Bureau of Mines and Geology proposes to publish a periodical to be known as "The Mineral Resources of Oregon" in addition to the special bulletins, this being the first number.

We believe the new plan will have many attractive and useful features. There is a great deal of interesting and valuable material collected incidental to the survey of the mineral resources of a state, which does not require the volume or dignity of a bulletin, which can be written up briefly and become of greater service to many people than some of the more extended material found in bulletins. Such material can be prepared in this way and given to the public promptly.

It is difficult for the public to realize the time necessary to get out an extended report upon a given area after the field work is completed. The details of making petrographical, chemical, and mechanical analyses of many hundreds of samples procured during the field work are usually lost sight of and a report is expected within a few days or weeks after the completion of the field work. Progress

reports, therefore, of the different projects under way will always be of interest and can come out through the periodical. The Bureau news can in this way be delivered to the public promptly to avoid the danger of burying a great deal of useful material in large volumes customary with a number of similar surveys.

It has not been found satisfactory to depend alone upon the press of the state to distribute the news of the survey for the reason that most of the material goes out as the result of interviews with men in the field. Such news is always unsystematized and often has little relation to former articles or interviews, with the result that the public gets unrelated stories instead of logical statements of the progress of the work.

It is our plan to have news items concerning the work of the Oregon Bureau of Mines and Geology go out through this publication, which, though available to all who apply for it, is nevertheless essentially a press bulletin. It will reach a very limited number of people. We hope that the press of the state will multiply the efforts of the Bureau by freely clipping from and commenting upon "The Mineral Resources of Oregon."

The Bureau publications can be secured by writing to the Director's office at Corvallis or by application in person at the Bureau Commission's office, 526 Yeon Bldg., Portland, Oregon.

ESTIMATE OF OREGON'S MINERAL PRODUCTION FOR THE YEAR 1913.

The different classes of mineral and geological products arranged in order of importance are: the metals, clay and clay products, the stone and gravel industry, coal, mineral waters, and lime. The total value of these products in 1913 was about \$3,650,000.

The year 1913 will be for sometime to come a prominent milestone in the history of the metal mining industry of Oregon. This is for the reason that this year marks a decided change from a series of years in which the metal production in Oregon gradually decreased to a year in which the metal production has greatly increased. The metal production in 1913 amounting to \$1,925,000 is practically three times that of 1911.

The reasons for this marked change are found entirely in the Eastern Oregon mining section. Something less than one-half

dozen deep mines have been in process of development during the past three or four years, most of which have come into production during the year 1913.

The large placer property of the Powder River Dredging Company operating in the Powder River Valley near Sumpter has been prospecting and developing during the past two years. This company began operating one of its nine foot dredges in January, 1913, furnishing an additional production in gold and silver to Oregon's output equal to the best mines in Eastern Oregon.

The deep mines in Eastern Oregon which have added to the metal production of that region are of two classes, those which concentrate their values and ship to smelters and those which amalgamate and cyanide their ores and ship bullion to the United States assay offices. Those which have concentrating mills are the Ben Harrison, the Humboldt, and the Highland. The Cornucopia in the Cornucopia mining district and the Rainbow in the Mormon Basin mining district have strictly first class cyanide mills each of one hundred or more tons daily capacity.

The real reason then for this marked increase in the production of gold and silver is found in these four or five deep mines and the Powder River Dredge in Eastern Oregon.

The Southern Oregon section has in certain localities some increases, which in others are balanced by a similar decrease, the sum total of production being only slightly different from that of 1912.

The total production of gold, silver, lead and copper in Oregon in 1913, was, as nearly as we can estimate it, \$1,925,000. Of this amount, \$225,000 in gold and silver came from the Southern Oregon mining district. The ratio between the placer and deep mining production being something more than two to one. This production came from the following counties arranged in order of importance: Josephine, Jackson, Lane, Douglas, Curry and Coos.

In Eastern Oregon the total output in 1913, was \$1,700,000 and came from the counties, in order of importance, as follows: Baker, Malheur, Grant, Wheeler and Crook. Of this total production in Eastern Oregon more than seventy-five per cent. came from deep mines. Eastern Oregon has increased the list of regular producing mines from one in 1911 to six in 1913. In 1912 the lode mines of this section produced \$489,763 in gold while the placer yield was \$45,266.

One of the most encouraging features in mining in Eastern Oregon

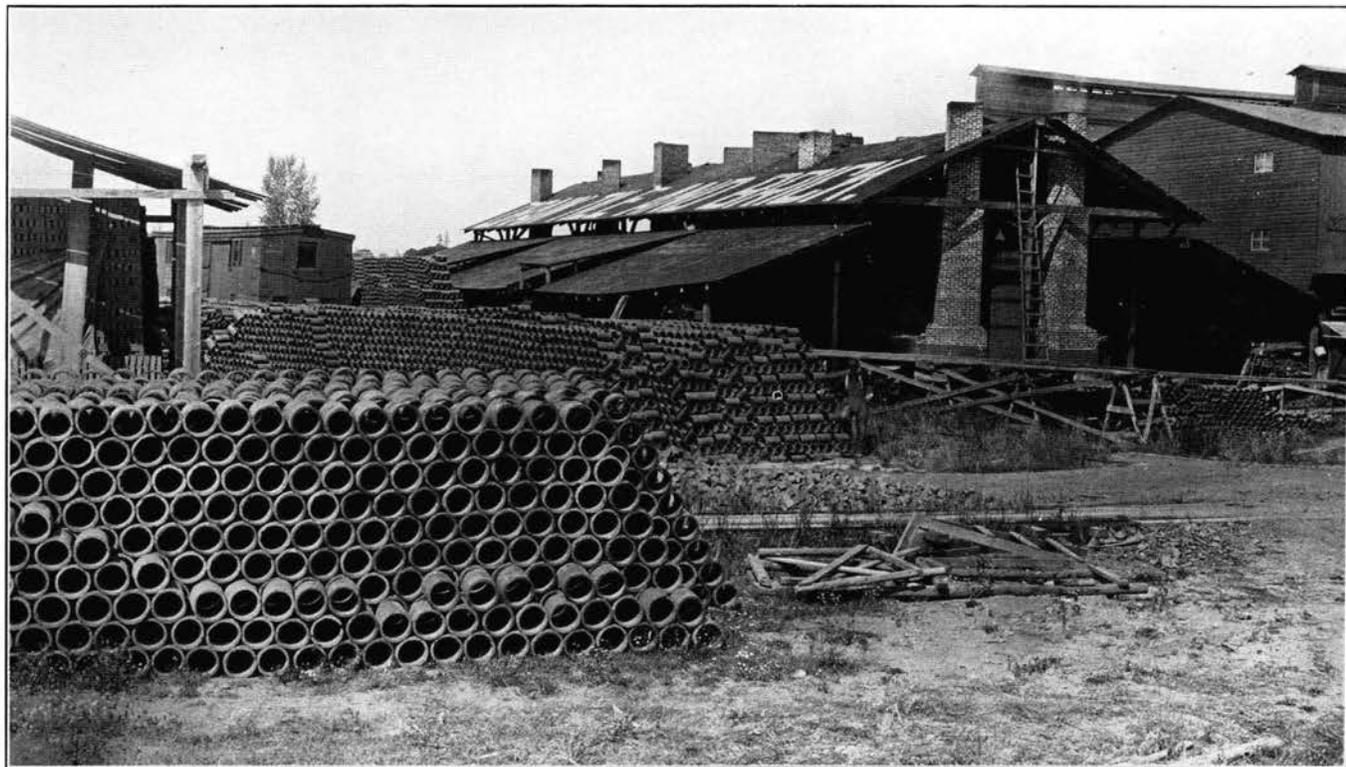
is the fact that the development of these steady producers during the past three or four years has demonstrated that adventurous or random mining is being supplanted by mining as a business. Less than half a dozen experienced mining engineers came into the Eastern Oregon section a few years ago and it is due very largely to their good management that these mines have been placed on the producing list. Had the Rainbow, Ben Harrison, Cornucopia, Humboldt or the Highland been managed in the same way that some Oregon mines have been managed in the past they would today be little more than holes in the ground. There are other properties in Eastern Oregon both developed and undeveloped which with the aid of trained engineers could also become steady producers.

As nearly as can be estimated before the detailed reports of production are compiled, the output of Oregon clay products for 1913 will show a decrease of about ten per cent. from that of 1912. In round numbers the value of the 1913 production is about \$700,000. This includes common and face brick, drain tile, fire proofing, fire brick, sewer pipe, hollow building blocks, and partition tile, besides stoneware and earthenware pottery.

Among these various clay wares the greatest falling off is in common brick, the number made in 1912 being a little short of forty-eight millions with a value of about \$364,000, while in the year just past but about thirty-seven millions were made having a value of approximately \$290,000. The output of drain tile has about held its own with that of 1912.

It is of some interest to note that while in the production of common brick there was a marked falling off, a portion of this loss has been made up by the growing production of common and patented hollow clay blocks, and of partition building tile. These wares take the place of the brick in wall construction and it is doubtless because of the dawning realization of their advantages that the demand for them has so rapidly sprung up in the past year. Their future is a promising one. A few hundred dollars worth of clay was mined and sold in the raw state in the past year.

Building, monumental and paving stone, crushed rock for macadam and concrete work and sand and gravel have maintained about the same production as in the past two years, 1911 and 1912. Of these, sand and gravel shows a material increase in 1913 being about 1,300,000 yards. This is some twenty-five per cent. more than 1912. The largest amount of sand and gravel is used in Multnomah County



Portion of Plant—Brick, Tile and Mercantile Company, Salem, Oregon.

in the vicinity of Portland but the increasing use of these materials in street pavements and concrete work is distributing their use more widely over the state.

The crushed rock and stone industry, shows a slight decrease from that of 1912.

There seems to be little change in the coal production, the amount sold in 1913 being about 40,000 tons.

MINERAL SURVEY A NECESSITY.

There are better reasons for a state investigation of mineral wealth than for any of its other resources. This is a fact not appreciated by a great many people. It cannot be disputed that of the many kinds of materials and products required in every day life, those originating from natural deposits in the crust of the earth itself out-number all others.

As proof of this we need only to recall, for instance, that the brick, stone, plaster, cement of which houses are built all come from naturally occurring raw materials; that the window panes, all metal fixtures, hinges, latches, locks, etc., likewise come from the same source; and finally that the pots and kettles, stoves and furnaces, and the coal, oil or gas, burned in them, bath tubs and sinks, water pipes and electric light wires, tinware and crockery, silver and all table ware, the vase on the shelf, the mirror on the wall, the time-piece upon one's person, all spring from the rocks of the earth. Every machine of metal has been produced from ores found in the earth. Every jewel is a product of the earth's crust. The study and discovery and use of materials so vastly important becomes then a necessity to the comfort and very existence of humankind.

These materials are not to be seen scattered about over the surface of the land, but come almost entirely from below. They are hidden beneath the soils and within the rocks, and to their discovery must be brought a different kind of knowledge and different methods than are required, for example, by the agriculturist in the study of soils and soil products.

To locate geological deposits one must, of course, take advantage of every opportunity to secure a peep below the surface, in mines, wells and drill holes, and in the canons and deep gorges of streams. But more important than the information gained in that way is that which comes from a knowledge of the kinds of rocks, and their structure and position in the earth.

The geologist, therefore, necessarily deals with things and conditions often deep beyond the range of actual sight but largely through evidence that is to be had here and there at the surface; the agriculturalist deals with materials that are within view and with conditions that are tangible, that can be observed and measured.

Considering, therefore, the incomparable importance of the geological resources and the greater difficulty attending their investigation, the extreme value of such work and its necessity become strongly apparent. Our present system of education allows so small an amount of training along this line that the average person is not able to intelligently observe geologic facts nor to apply them in discovering or utilizing such materials, even though he may come in contact with them daily.

For example, the agricultural resources of Oregon are much more evident, and the products of the soil more readily obtained by the ordinary individual with little or no experience as a farmer, than are the products of the mineral wealth of the state. A very valuable deposit of clay might remain for hundreds of years in a densely populated portion of the state without being used because the persons who came in contact with it from day to day were not able to see in it the possibility of fine pressed brick or pottery ware.

An extensive outcrop of rock, or an area of stony land may be worthless considered only from the agricultural standpoint. While with competent investigation and in the proper hands, one or both may often develop into excellent building, monumental or ornamental stone, or one useful in the manufacture of lime or Portland cement.

So, while the thorough investigation of all of the natural resources of the state is highly important and to be desired, certainly a knowledge of the sources from which can be had so large a proportion of the necessities of life, for some of which we now annually pay almost prohibitively high prices to outside states, is absolutely indispensable. It is the function of the Bureau to carry on, as rapidly as the appropriations for the work will allow, such field investigations as will assist to speedily render available every one of Oregon's mineral resources.

SURVEY METHODS.

Before a systematic study of the geology of a region can be successfully undertaken a topographic map of the area must be at hand.

This is the base map upon which the geologist plats the outcrops and all artificial rock exposures and other essential observations. The position of all observations is shown on this map both horizontally and vertically, as well as their relation to streams, towns, and prominent landmarks.

To illustrate the method pursued suppose the geology of a metal bearing region is to be studied. With the topographic sheet at hand the geologic party will enter the field and first locate the rock exposures, mines, quarries, etc. Then a detailed study of the kinds of rocks and their structural and genetic relationship to each other will be made. The geologist will give special attention in the field to any evidence bearing on the source of ore bodies and how they occur with reference to the enclosing rocks. A careful record of features of rock structure will aid in determining the way in which the ores were deposited. He will obtain samples for minute laboratory examination from every point where it might be expected to find evidence as to the nature of the ore-forming processes. The geologist notes also the extent to which the country has been subjected to these processes and if possible the relation of the processes to each other.

It is not generally understood that in most geological work the completion of the field investigations is but the lesser part of the labor of finding out what is to be known about the region studied. During the field work several hundred samples will perhaps have been taken from outcrops, mine openings, and other exposures, every one for some definite purpose. The preparation of an intelligent and useful report requires the careful study of every sample collected and most of them thin or polished sections will have to be made for examination under the microscope. Opaque minerals, such as a few of the metallic compounds prove to be, are studied on the highly polished surfaces of the rock or gangue in which they are found; while most other rocks and minerals will allow light to pass through when very thin slices are made of them. The amount of careful work necessary in preparing these specimens will be realized when it is stated that each thin section, which when finished must be less than two one-thousandths of an inch in thickness, must be sawed from the rock, carefully ground down and polished on both sides, and mounted on a glass plate before the microscope can reveal the story it has to tell.

It is only by this kind of an examination that the petrologist finds

evidence which enables him to state conclusively whether a certain fine-grained sample is a metamorphosed sediment or a dense rock of igneous origin, a question which field inspection of the same samples fails to answer. He also finds signs of mineral replacements, alterations, etc., which may throw light on many of the ore formation processes, that would be entirely unsuspected from what could be seen in the rough samples in the field. Thus problems of relationship between ore, gangue and wall rocks may be cleared up, questions which are apt to have a great deal to do with prospecting for and the economic development of the ore bodies.

In some instances, chemical analyses will have to be made to settle questionable points. As a rule, however, hand and microscopic examinations provide as much chemical information as is required.

Besides the above detailed study of the rocks and ores in field and laboratory, the correct mapping of geological formations, dikes, faults, etc., is fully as essential and valuable in aiding a geologist to properly correlate the structural data observed in different parts of a district as is the drawing of plans to a contractor in building a house. These maps, too, must be prepared in the office after a seasons work is over, from notes and sketches recorded in the field, and making use, of course, of any other maps obtainable along with the especially serviceable topographic sheet.

After the above work has been completed the results of field and laboratory investigations are to be correlated in a systematically written report. The maps and analyses, and structural sections are the framework of the report, and the descriptive matter is to their complete understanding as requisite as the specifications to the intelligibility and value of the plans of a proposed building construction.

It is plain, therefore, that a geological report represents vastly more than the time spent in the field work. Impatience is sometimes expressed over the fact that after a region has been covered by a field party, a report is not at once forthcoming. Disappointment is also sometimes felt at the seeming reasonless refusal on the part of the geologist to make definite statements as to the value of a prospect, or of a mine as soon as he has completed the field examination of it. Geologists are not wizards and while they may at times have decided opinions as to a property on first inspection, it is not at all infrequent that such opinions are found quite incorrect or even reversed by the facts brought out in a later study of the samples

collected, notes taken, and sketches made showing their relation to each other and to the whole region. Decided field opinions are, therefore, as a general thing unsafe information to offer and even more unreliable to accept. Only the well considered, carefully written report should be asked for and be accepted with confidence. At the same time a reasonable forbearance should be a virtue of those whom the information is to benefit to remember that the work in the field is but a fraction of the actual labor necessary to make a geological report as valuable as it may prove to be.

ACTIVITIES OF THE OREGON BUREAU OF MINES AND GEOLOGY.

The Oregon Bureau of Mines and Geology will publish before the end of this year a dozen principal reports besides numerous small ones as the result of investigations made in 1913 and 1914. The order of these publications cannot be announced at this time. These separate reports will deal with the discussion of building stones, coal resources, clay and clay products, the metal mining industry, cement materials and road materials.

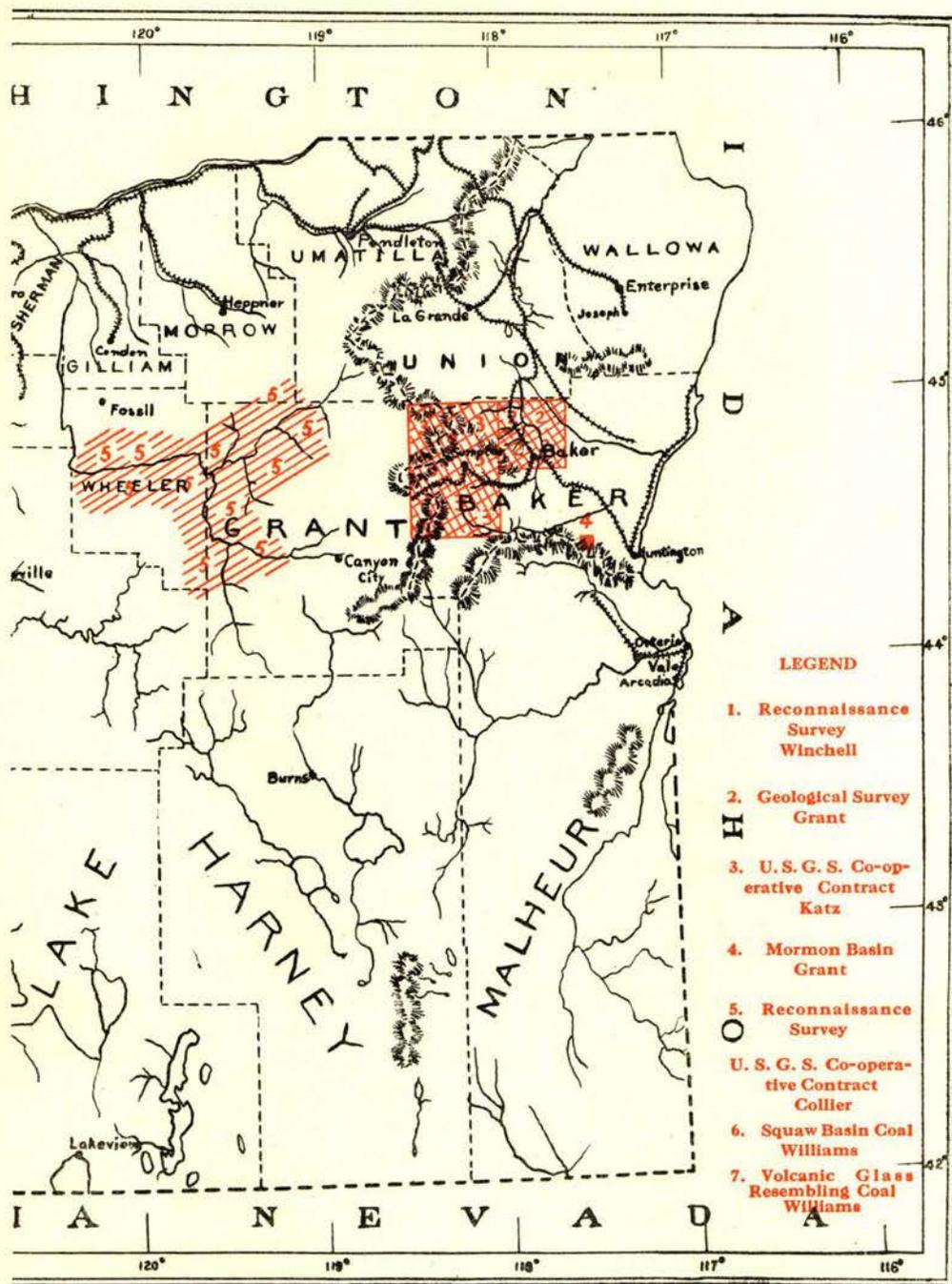
The work of the Oregon Bureau of Mines and Geology is similar to that usually delegated to state geological surveys but with more emphasis placed upon the economic side than is usually done in such surveys.

When starting the investigation of the mineral resources of a state as large as Oregon so many and varied problems present themselves that it is difficult at times to decide what should be first taken up and where it should be begun. Although the law providing appropriation for the Bureau did not go into effect until the third of June, 1913, the Bureau organization was so promptly accomplished that most of the summer of 1913 was utilized in field work. Nine different divisions of the work of the Bureau have thus far been undertaken.

First, the coal, oil and gas resources of the John Day Valley in Central Oregon were investigated by Arthur J. Collier's party. This work was carried on in cooperation with the United States Geological Survey, the expense of the survey being divided between the Oregon Bureau of Mines and Geology and the Federal Survey. There have for a number of years past been numerous reports come



Outline Map Showing Where Some



of the Field Work was Done.

in from this region of coal discoveries and Mr. Collier's report on this area should be of value to the people of the John Day region in showing whether or not deposits of commercial value can be expected in this region.

Second, Ira A. Williams, the ceramist for the Bureau, is investigating as fast as possible the clays of the state to determine their qualities for use in the manufacture of the ordinary clay products. Samples of brick of the different grades and of drain tile, are being collected and complete strength tests will be made. The results of these tests will enable manufacturers of Oregon clay products to compare their goods with those from neighboring states with which they must compete. At the same time careful attention is being given to reported occurrences of clays that may be found suitable for making the higher grades of clay wares, such as Oregon uses large quantities of but does not now manufacture. With the very extensive equipment which is being installed in the Ceramic Department of the School of Mines at the Oregon Agricultural College and made available to the Bureau this work should be of benefit to the clay manufacturing industry.

Third, Solon Shedd is making a large relief map of the state of Oregon. Mr. Shedd is one of few qualified to do this work. His map will show on the horizontal scale of four miles to the inch, the mountains, valleys, and streams in actual relief. It will be a valuable base upon which to show other resources of the state. For example, the State Forester will be able to show much more clearly the relation of the state forest to the topography bringing out the fact clearly that some varieties of timber are limited to certain elevations. The map will be of value in a similar way in showing more clearly the climatic relations between the topography and agricultural and horticultural products.

Fourth, George D. Louderback is correlating the scattered geological data which has been published concerning Oregon especially with reference to the stratigraphy or geological history of the state as far as it is known and will present it in one bulletin.

Fifth, in the past few months there has been a great deal of newspaper comment on the question of Oregon's building stone resources on account of certain public buildings which are proposed in Portland and other cities. Hence, it seemed opportune and proper that the Oregon Bureau of Mines and Geology make an inventory of the quarries in the state which are more or less developed to get



Albany Sand and Gravel Company's Dredge, Willamette River.

some immediate information as to the possibilities of using Oregon's stone in these public buildings. To this end all of the partially developed quarries of the state were visited by H. M. Parks and careful and representative samples taken from each quarry. These samples have been prepared into test specimens of different kinds and part of each sent to be tested by the Supervising Architect of the Treasury Department, Washington, D. C., while the remaining samples are being tested by the Oregon Bureau of Mines and Geology. This report is not quite complete at the present time, but will be available in the near future.

Sixth, there were three parties sent into metal mining sections of the state to gather information concerning their economic resources. One of these parties under the leadership of Alexander N. Winchell covered a considerable portion of Jackson and Josephine counties. This party examined in some detail the outcrops and general geological features as well as the prospects and mines. A large number of samples of ores and wall rocks, minerals and country rocks were taken. After a careful investigation of these numerous samples together with the field notes taken while on the ground a report will be written having to do essentially with the genetic relation of the ore deposits in the section covered. Such information ought to be of value to the miner and prospector in guiding him to the more fruitful areas as well as giving suggestions as to the depths at which he may expect to find the better ore deposits.

Seventh, a similar party under U. S. Grant covered a considerable area of the Baker Quadrangle of which Baker is the center. His investigations and report will be similar to that described under Mr. Winchell's party above.

Eighth, the Sumpter Quadrangle is a rectangle in the western part of Baker County about twenty-five miles east and west by thirty-five miles north and south, with Sumpter nearly in its center. In 1908 J. T. Pardee of the United States Geological Survey began a survey of this quadrangle. During the summer of 1913 this survey was continued by F. J. Katz of the U. S. Geological Survey as a result of a cooperative contract with this Bureau. The contract calls for a preliminary report upon this quadrangle to be published before December 1, 1914, and subsequently a complete report or geologic folio will be forthcoming. We are confident that the reports coming from these three areas will be of considerable value to the industry in the sections covered.

Ninth, the seventy-three metal mining districts in the state cover such a wide area that it was impossible with the appropriation at hand to do sufficient geological work in each to be of much value. The party in Southern Oregon was able to cover considerable areas of Jackson and Josephine counties while the two parties in Baker County were able to complete a considerable area but there is a vast amount of territory untouched by these parties upon which the survey was in need of much general information.

To secure this a scouting party was organized with A. M. Swartley, mining engineer for the Bureau as its head. Its purpose is to make a preliminary examination of the prospects and mines developed and undeveloped and thus obtain first impressions of the mineral resources of the different sections for determining the districts of greatest promise. Also to find out what problems the Oregon Bureau of Mines and Geology should next take up with advantage.

A review of the mineral resources of the state will be published next fall and the information secured by him will be used to guide the future investigations of the Bureau in metal mining regions. Mr. Swartley was able to cover during the summer a considerable portion of the Eastern Oregon section and will as soon as weather conditions permit continue the field work in the remaining districts of the state. This report will be of service to the mining industry and will be followed by detailed surveys in succeeding years which will give all of the useful information to miners and prospectors that it is possible to give in any survey.

IS SWARTLEY RIGHT?

Discussion in the mining press, concerning stagnation in the metal mining industry and the causes therefor, has been considerable of late. The conclusions reached by the writers of these articles are not satisfactory and we asked Mr. Swartley to state what he considered to be the main causes which have retarded activity in the West, together with remedies, especially those which would affect the Oregon Bureau of Mines and Geology in its relation to the metal mining industry of the state. We believe that Mr. Swartley's exposition of the subject hits the nail squarely on the head and that he is the first one to get at the vital reasons and remedies for the present general stagnation in metal mining. Because his discussion applies as much to hundreds of other mining districts as those in

Oregon, the Engineering Mining Journal has gladly given space to the article. We hope that it may provoke constructive criticism in a much larger sphere than if confined to our own periodical.

The Commission of the Oregon Bureau of Mines and Geology placed Mr. Swartley on the staff of the Bureau because, besides possessing good engineering qualifications, he has a keen sense of values, especially of metal mining prospects and partially developed mines. This rare qualification is partly inherent and partly acquired through contact with the prospector and mining conditions in a number of camps in the western states. I find that his conclusions check closely my own experience. I believe that there are a number of opportunities for investment in partially developed mines and prospects in this state, and that it is peculiarly the problem of the Oregon Bureau of Mines and Geology to bridge over the gulf and bring the prospector into closer touch with the investor.

While this article sets forth our views as to remedial methods which our Bureau might well follow, nothing definite can be stated at this time as to its policy in this regard. The Director will appreciate, however, any comment upon Mr. Swartley's discussion. We believe the opinions of mining men would be of great assistance to the Bureau in determining these fundamentals in policy and we urgently request that you give us freely your criticisms and suggestions upon this or any other matter affecting the betterment of the industry which is your aim as well as ours. Let us hear from you.

H. M. PARKS.

WHAT IS THE MATTER WITH THE MINING INDUSTRY?

*BY A. M. SWARTLEY.

Although the leading producers, because of increased facilities, are making our production of the metals equal to that of our best years, much has been seen of late in the technical press concerning stagnation in the mining industry.

This is a question of considerable importance and of absorbing interest as well. It is the frequent topic of discussion in the mine office; in the prospector's cabin it is daily the subject for disquieting thought. What the cause and what the remedy, if any, is well worthy of our most serious attention.

The authors of these editorials and signed articles, alarmed by the stagnation in the development of the non-producers, and the failure of the prospectors to find many new camps or to make sensational strikes in old ones, have attempted to diagnose the disease and to prescribe a remedy.

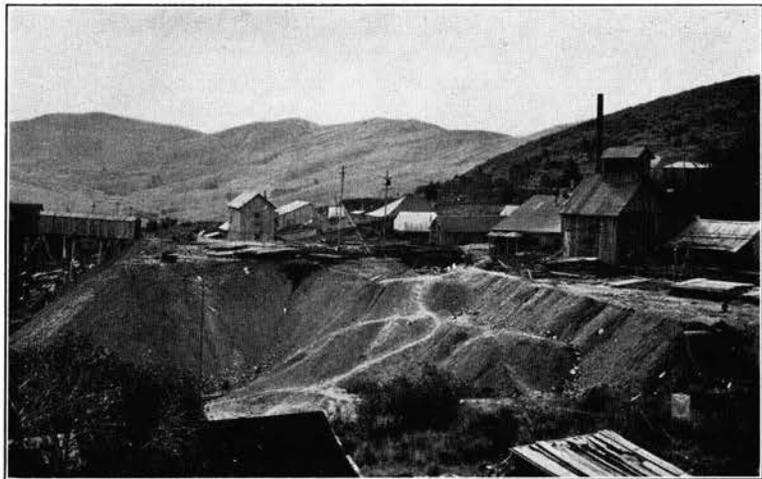
With many of these articles I am unable fully to agree although there is an undoubted dullness in the buying and selling of mining property, a lack of energy in the search for new districts and new prospects and owners of the non-producers are doing but little more than the required assessment work.

PROMINENT ENGINEERS' OPINIONS.

According to one,† a principal cause is "the exhaustion of the easily discoverable, easily developed ore resources of the United States, which has greatly reduced the opportunities of the prospector and of the mining operator of small means. This is not a sudden change, but is one that has been progressive through many years. Ore discoveries were many and frequent in the '60s and '70s, fewer and less frequent in the '80s, and still more so in the '90s. Since 1891 the only new mining districts of magnitude have been Creede, Cripple Creek, Tonopah, Goldfield, Cobalt, Porcupine and the

*Mining Engineer, Oregon Bureau of Mines and Geology.

†Editorial "Engineering and Mining Journal", November 1, 1913.



Humbolt Mine—Mormon Basin, Eastern Oregon.



Placer Mining in Southern Oregon.

placer districts of Alaska; no great number for a period of 20 years."

* * *

"In fact, the demand for good copper, lead and gold mines is no less keen. Unfortunately, it is not known where they are. We do not mean to imply that there are no more and that they will not be found, but probably they are for the most part deep-lying deposits whereof there is little or no surface indication, deposits that await deep and costly exploring before they will be found."

Statements essentially like the foregoing have been recently expressed by H. Foster Bain, Albert Burch and others. The impression conveyed by each is that new discoveries and new districts are necessary prerequisites to a revival of mining. To state the corollary: Nearly all the meritorious discoveries are being developed and the remainder have been shown to have too little merit to warrant further expenditures.

FIELD MEN BETTER JUDGES.

Possibly the great success of these men may have militated against their complete understanding as to what is really the matter with the mining industry. Perhaps a less successful man, because of his more intimate contact with field conditions, might offer a better solution.

The very successful mining geologist or engineer employed by the larger corporations is inclined to do his financial thinking in terms of six or more figures and not in that of proportionate profit. He is inclined to measure a mine with standards derived at the Bunker Hill and Sullivan, the Utah Copper, the Homestake, or the Treadwell and considers anything smaller unworthy of attention. The small mine has little place in his scheme of things. He visits a district because he is sent there to value a certain property. He is not sent there unless his clients have become assured that there is apt to be ore-bodies sufficient to return to them net the price asked for the mine. He visits the property in question, and, if impressed, samples it, studies its immediate geology, and hastens back to his office to write his report. From thence, he goes perhaps to another quarter of the globe. The conditions of his employment are such that he does little scouting while in the district and much too often his attitude of mind, due to his associations, precludes a fair consideration of anything but proved ore-bodies.

THE TRUE SITUATION.

The situation as I have observed it in several states is somewhat as follows: the prospector is not making new discoveries in old districts and very few new discoveries in new territory because he thinks it folly to open up a new prospect until someone sells an old one. He sees properties with a thousand feet or more of useful development, making what he considers to be a good showing and warranting vigorous continued development, go year after year without opportunity to make a sale. He observes that the owners, because of poverty or discouragement, resort whenever possible to a lease and bond to men without capital or other assets, in order to avoid expenditure for annual assessment work. These leasers in order to make beans and bacon, "pick the eyes out of the mine" to make shipping ore, which upon the termination of the bond leaves it less salable than at first. The prospector is, because of these discouragements, losing faith in man though not in nature. His faith in nature is steadfast and enduring but he has been taught by experience that under present conditions there is an over-production of well developed prospects, "near mines," and until a bona-fide sale occurs now and then he will only half-heartedly work his claims and will make but fitful efforts to find new ones.

It is manifestly absurd for any one man to decide from personal observation that there is an exhaustion of the easily discoverable ore-bodies in the western states. It would take him more than twenty-nine years to visit the 1480 mining districts of the thirteen states devoting only a week to a district. On the other hand there would be some justification for an engineer's conclusion that they are by no means exhausted, if, after rather careful scouting in many districts, he has seen in these old camps a considerable number of properties, which have reached the limit of development for the owner of small means, though having little or no ore blocked out, yet show the top level or two of good ore-bodies. Would it not be logical for him to further conclude, that in many of the hundreds of districts which he has never seen are also many others of like merit awaiting only energy, money and brains to make them successful producers?

Of course, it all comes back to the competency and credibility of the witness, and manifestly one cannot testify as to his own ability to determine the merits of undeveloped mining properties. The thing which has especially impressed me in confirmation of the correctness of my opinion is that almost every time one of these

partially developed properties has been taken over by an experienced school of mines man, the undertaking has been successful. It might almost go without saying that they are men with ten to fifteen years of broad experience in engineering and executive capacities. Such men rarely fail to determine with comparatively small expense the character of a property before the first payment upon the bond falls due, and if they take it over they rarely fail to make it a successful producer.

If there is such a considerable number of good partially developed properties, Why this pronounced stagnation in their sale and development? might well be asked by the "man from Missouri". Any discussion which denies exhaustion of the easily discovered, easily developed ore-bodies would be incomplete and unsatisfactory without an attempt to answer this question.

CAUSES OF STAGNATION.

Many have placed entirely too much emphasis upon the "wild catter" as a factor in bringing about stagnation. He can be blamed for much but not for all. A good property in the hands of an honest but incompetent man is not only liable to lose the investors' money but will invariably do so. "Some men could not mine solid gold at a profit". A fairly competent business man with but little knowledge of mining has small chance of making a successful mine, because, he nearly always lays aside those methods which have made him successful in other lines when he enters the mining field. The glamour surrounding mining—the intoxication of the game—has gotten into his blood obscuring his better judgment. A "practical miner" although controlling sufficient funds fails because of utter lack of business system, because of ignorance and misconceptions of metallurgical processes, and because of inability to choose the right man to solve his problems or to give the right man free rein to solve them should he by chance have secured the services of such a one. An honest man, trained technically and in the school of experience, with abundant energy and common sense will miserably fail nine-hundred and ninety-nine times out of a thousand, if he has not well counted the cost. Even then he is liable to fail if he has not seen to it that sufficient money will be placed at his disposal as he shall require it, with but little interference by an outside directorate. Honesty, energy, brains and money, each and all, are required to make for success. United they stand, divided they fail.

He whose business takes him systematically to district after district is almost nightly regaled with story after story of the dishonest promoter of the boom days whose pay streak was in Pittsburg. He sees during the day where the abortive attempts of retired preachers, granger mining companies, etc., to develop a mine have failed. He is made pensive by the sight of fairly well developed properties lying idle because a "practical man" built a jim crow mill which sent the values down the creek. He is pained to note other cases where otherwise competent men have, like the man in the parable, failed to count the cost. Nearly all in the past, and many still in the present, have looked upon mining as an adventure, a chance, a lucky strike, but not as a business. Small wonder that the vast majority met the fate of the adventurer and the "fall guy."

The publicity attendant upon the trial of Leston Balliet, Whitaker Wright and others, the public and private disclosures of hundreds of other dishonest promoters, the activity of the Post Office Department, the many articles in the popular magazines, the enactment of "blue sky laws" and the almost invariable failure of amateur mining companies have all combined to drive the brass-band promoter and the itinerant peddler of mining stock from the field.

The promoters and amateur mining companies were, however, the principal purchasers of prospects, creating a ready market for any good discovery and for many that were not. This resulted in great activity in prospecting since the demand for discoveries exceeded the supply while now the supply vastly exceeds the demand. The prospector is now left with claims on his hands too good to abandon but upon which he must perform his annual work. He has little time or money to search the hills and, besides, he is too discouraged to do so.

Although these promoters lost most of the investor's money and did much useless development, nevertheless, every year several properties passed to the list of steady producers. Now that they are out of the field there are few to take their places, so that even now they, who buy nothing but mines, are complaining of a scarcity.

It seems to me evident then that the stagnation in mining is not due to the exhaustion of easily discoverable ore-bodies but to the fact that those, who have in the past been the principal purchasers of prospects, have been driven from the field, and justly so, while a sufficient number of buyers of the right sort have not come forward to take their places. When these arrive we need not worry about

the fate of the poor old prospector. He has done his part but we are not doing ours. When we work the ones he has discovered, he, or they who come after him, will search for more and will find them; all this talk of exhaustion notwithstanding.

MANAGER-ENGINEERS—ONE REMEDY.

What then is the remedy? Whom can we get to make wise selections of properties and to open them efficiently and well? The school of mines man or a man with equivalent training, well seasoned in the school of experience, in charge of development companies is the thing. Men who have had ten to twenty years of engineering and executive experience in widely separated districts are in sufficient numbers to do this work.

The managing engineers are the men who are adding more to the list of steady producers than any other. Because of the few existing development companies their number is small, yet they are steadily coming into their own. For example, Northeastern Oregon, comprising several mining districts, three or four years ago had only one steady producer. The metal production was annually declining. Its early promise and the optimistic report of Waldemar Lindgren in 1900 was accompanied by great activity of the promoters. Later, the disappointed stockholders having withdrawn their support, the region settled down to small activities. Sporadic attempts from time to time were made, usually with too little capital, to carry the enterprise through. Fortunately for this region, about three years ago men of the engineering type, less than half a dozen, came there to investigate certain properties. They stayed; they had financial backing; they developed in 1911; they developed and constructed in 1912; and in 1913 they have more than doubled the metal production of the State. There is room for others in that region and in many others of the west.

How can such development companies be financed when there is but one optimistic voice crying in the wilderness and that but a weak and obscure one? The mighty voices, at least those which have spoken, are on the pessimistic side. Publicity can do much, but what we are now having is deterrent in effect; though untrue, if persisted in it may generally be accepted as a truism, like that of the force of dynamite being downward. If it is really true, no publicity campaign is needed. Bad news travels fast enough. If not true, the concerted efforts of engineers generally would, though

helpful, improve the situation but slowly. Their reports, usually on one mine only in a district, are the property of their clients and are not often given out unless unfavorable.

The scouting engineer for a development company, by going into the field to search for a partially developed prospect, will find one in time if he has not had the misfortune to associate too long with that type of engineer who, in order to protect his reputation, makes all his reports negative. The scout goes to a prospect in a certain district in one state, and next in order may be one in a distant state. The low efficiency of this method reminds me of the reply of a prospector to my question as to how long he had prospected in that district. To this he replied "I have been in the district twelve years but have prospected about thirty days, the rest of the time I put in cooking meals and chasing horses."

However much we may deplore the low efficiency in the methods of private organizations used in finding new properties, little in the way of improvement can be anticipated. Without an organization of trust proportions they cannot be expected to make systematic regional investigations.

The prospector by reason of his isolation and educational limitations cannot be expected to make much improvement in his method of bringing his property to the attention of development companies.

It is evident then that private agencies are and will be insufficient to bring about a substantial revival of mining.

FEDERAL SURVEY INEFFICIENT.

Help, more effective and more efficient, can be gained through a decided change in the method pursued by public agencies, the geological surveys. In recent years the United States Geological Survey has become most active; in recent years stagnation has become most pronounced. Why has the Federal Survey not met the needs of the mining industry? It has become entangled in a web of its own and others' weaving. It developed from a somewhat small beginning during the time when low salaries prevailed and a position with the Federal Survey was a badge of distinction. It has grown to large proportions and varied labors. It serves to a large degree the various departments of the state. Its geologic work is weakened by the superficial requirements of land classification, by underground water surveys, water power investigations, and all of those distracting influences which are the result of the hue and cry of

the conservation movement. The result is that comparatively little geological work *per se* is being done. The man of prestige leaves the service because when promoted to position of chief of a division he is tied down to an administrative desk, to the work of committees on unity and conformity, and the criticism of other men's manuscripts, so that constructive work of his own is impossible of fulfillment.

The immense area of our possessions with its varied resources so far but little covered makes many demands upon the survey unable to be fully met. The result is that we have, in the main, geologists of little reputation scurrying hither and thither, now a week or a month or two in Maine, next the same length of time in Texas or the Hawaiian Islands. Afterward, too often long afterward, they prepare from these hurried visits short papers or preliminary reports with the idea that at a later time they will return to complete their investigations, after which a final report will be written. But so many investigations are started and so few completed that we have many papers of all sorts, largely made up of a mass of undigested facts, which few read, and which are disappointing to those who have the hardihood to attempt them. Where field work is done preparatory to final reports or geologic folios the effect to economize makes the report so superficial that it is of little benefit to prospectors and developers. The geologist usually has a pronounced hobby or a pronounced weakness. He may be obsessed by the importance of stratigraphy or be weak in petrology. Because of the lack of engineering training and experience, he may go far at sea with reference to some alleged economic deposit.

But even though capable, neither the time nor the custom of the survey permits an economic bulletin to give the merits of partially developed prospects. By the time the manuscript has gone through the fiery furnace of criticism in Washington, if it had much force in the beginning, it will have lost much of its vitality. Whatever the nature of the field work or the quality of the manuscript when written, and censored, the fact remains that much too long a time intervenes between the beginning of the investigation and the distribution of the reports.

EFFECTIVE SURVEY METHOD SUGGESTED.

Much more effective work could be done with a few survey parties permanently assigned to a particular mining region with a reputable

mining engineer in charge of the work and a chief geologist, thoroughly conversant with economic geology, associated with him. A sufficient number of assistant geologists to thoroughly cover the various phases of geological study and as many assistant mining engineers, metallurgists, draftsmen, samplers, assayers and miners as needed should also be in the parties. Such an organization would make full reports on prospects and mines as well as sufficiently detailed information of the geology of the region. Their maps could then be upon a much larger scale permitting details of dikes, veins and smaller outcrops utterly impossible of representation upon the maps with scales now in use.

The duties of the chief geologist would be to work out the geology of the mines and more particularly the partially developed prospects and to critically supervise the work of his assistants. The work of the mining engineer and his assistants would be to conduct a thorough mine examination, especially of the partially developed prospects, which examination, in conjunction with that of the chief geologist, would enable them to advise the owner as to its future development or abandonment as well as make it possible for them to state in their reports something of its value and desirability. Progress reports should be issued at least semi-annually, in which the conclusions reached as to the new areas covered could be given.

Work of this kind, conducted and directed in person by engineers and geologists of reputation whose reports would be stripped of much useless verbiage and containing correct scientific conclusions, which are at the same time practical conclusions, would be siezed upon eagerly by prospectors and investors. The field agent or scouting engineer for development companies would not be required to travel from state to state for two or three years to examine those properties called to his attention by those who had them for sale. Instead, his company, by referring to the progress and final reports of the areas already covered by the surveys, could instruct him as to the region which they wish him to first visit and the properties in that region which they desire him to examine.

This would result in much saving to the development companies already existing, and would also bring about a large increase in their number. This would result in a decided increase in the sales of partially developed prospects to development companies, with most of the latter in the hands of mining engineers of experience. The

sale of these properties would free the prospector-owner from his entanglements and permit him to prospect elsewhere, while the prospector not so entangled would be encouraged, because of the sales, to make another effort.

STATE OR NATIONAL SUPERVISION?

Whether this work could best be done under the direction of Federal or State supervision is an open question. I am inclined to think, however, that too much inertia would have to be overcome to make such a radical change in the methods of the Federal Survey. Such a change would be easier of accomplishment by the states though by no means an easy task. At present most state surveys are but reflected images of the Federal Survey due largely to the inviolable conditions imposed upon them in cooperative contracts with the Federal Survey. The Oregon Bureau of Mines and Geology, of recent legislative creation, governed as it is by a technical board and directed by a geologist-engineer is apt to be the first to adopt an effective policy.

SUMMARY.

I would have you believe that stagnation is the result of ignorance and dishonesty and not because of exhaustion; that prospectors will make plenty of new discoveries when sales occur now and then of the old ones; and that there are plenty of good old ones in many western districts dormant because the usual buyers have been driven from the field. I would especially have you believe that engineers directing development companies will improve the situation best of all and quite rapidly too if the methods of conducting geological surveys are made more efficient and practical.—*Engineering and Mining Journal*, January 24, 1914.

THE OCCURRENCE OF COAL IN SQUAW CREEK BASIN, COOS COUNTY, OREGON.

BY IRA A. WILLIAMS.

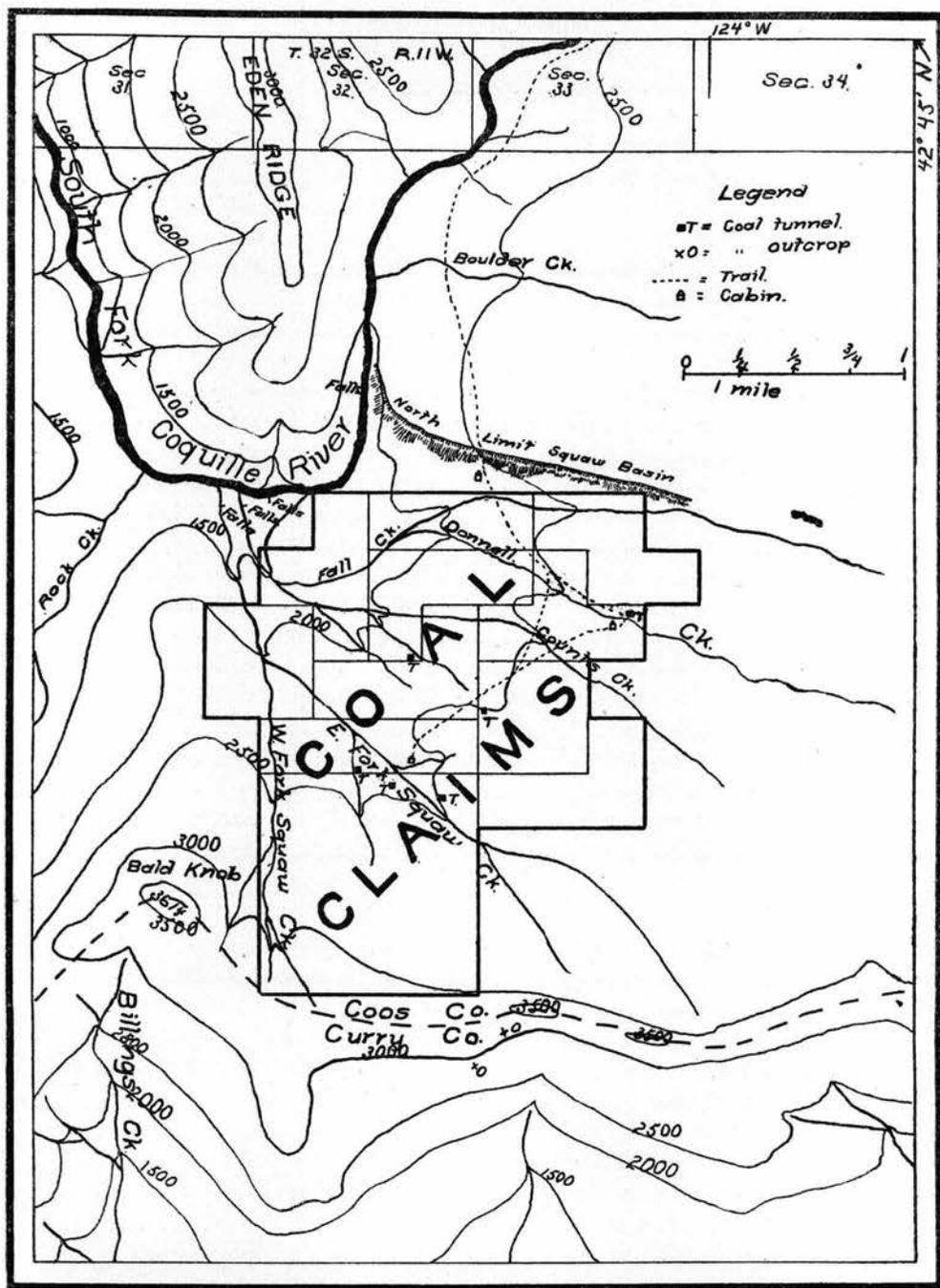
The field investigations of the Oregon Bureau of Mines and Geology on which this report is based were made in late October and in November, 1913. Two trips were made to the basin by the writer, the second in company with S. W. French, also of the Bureau. The field was very rapidly covered owing to the lateness of the season and the intervention of early snows prevented the examination of the surrounding region; but the information secured is such, nevertheless, as should be of much value to the people of the state. It is urgent that such information as is at hand should therefore be placed before the public at the earliest possible date.

No report on a new region can be a final or complete one, and especially is this true of a new mining region. Data correct and full when collected, may easily be out of date after the lapse of a few months or a year, or more. Prompt publication is thus as essential as the securing of the facts in the first place.

It is fully appreciated that in submitting this report some indefiniteness still remains as to the extent and character of the coal in Squaw Basin. This is inevitably so and so it will continue until development of the beds, prospect borings, shafts and other openings, actually determine these factors. But it is the work of the geologist to ascertain as closely as is possible by what can be seen at the surface of the attitude and nature of the rock strata and from such artificial openings as have been made what the economic probabilities are. In the following pages an attempt is made to so consider and interpret the geologic facts observed in the Squaw Basin as to render them of use to the prospector, the miner, and to the person who has money to invest in the coal fields of Oregon.

LOCATION OF THE BASIN.

The area under consideration lies within the drainage of the South Fork of the Coquille river, near the southeast corner of Coos County, Oregon. The boundary line between Coos and Curry counties here follows the crest of the divide, known as the Devil's Backbone,



Sketch Map Showing Location of the Squaw Basin in Coos County, Oregon. The Rectangular Boundary Lines Enclose the Area on which Coal Filings Have Been Made.

which separates the Rogue river drainage to the south from that of the Coquille. Squaw Basin is located upon the north slope of this divide and therefore just within the confines of Coos County.

No land survey has as yet been made of this region. The area of the basin falls, however, entirely within the boundaries of the township described as 33 south of the Portland base line and Range 11 west of the Willamette meridian. A southward curve in the Rogue-Coquille divide, which passes nearly midway across this township from east to west, marks approximately the south edge of the field.

Reference to the course of the South Fork of the Coquille river will further aid in establishing the location of the region. Taking its rise well up the slope of the Coast Range close to the edge of Coos County, the South Coquille makes a somewhat irregular though bold curve far to the south, then swings sharply to the northward, skirting in this portion of its course the base of a range of hills known as Eden Ridge. The prominent points on this ridge rise 1500 feet above the river at the east, 2000 feet from the south, and over 2500 feet above the stream at the foot of the escarpment to the west. In its westward course, and where this river makes its abrupt turn to the north, it cuts across the sedimentary formations which compose Eden Ridge and the Devil's Backbone and which occupy, therefore, the Squaw creek basin. Outside of this curve to the south and covering an area that has been deeply dissected by lesser tributary streams, the Squaw Basin is roughly circular in general outline, set against the Coquille slope of the watershed.

DISCOVERY OF COAL.

Squaw Basin is within but close to the eastern border of the Siskiyou National Forest. At various times since its withdrawal for forest reserve purposes in 1903, there have been reports of the finding of float coal along the streams. The first geologists to officially study the region were Messrs. J. S. Diller and A. J. Collier whose report was published as the Port Orford folio of the U. S. Geological Survey in 1903. A topographic map accompanies this folio. A folio of the federal survey represents a detailed study of the region it covers, including topography, geologic and structural features, besides its economic deposits. Although at that time the occurrence of coal in the adjacent Eden Ridge field was known, its existence in the Squaw field was not recognized.

Mr. M. J. Anderson of Grants Pass, then forest supervisor, was first to report the presence of fragments of coal in the bed of Squaw Creek in 1907. As a result of this find the area was withdrawn from coal entry through the recommendation of Mr. W. T. Cox then chief of Silviculture of the government forest service, the order of withdrawal going into effect June 22, 1907. In August of this same year, Messrs. J. S. Diller and G. F. Kay of the U. S. Geological Survey visited the region and on the basis of their unfavorable report the entire township was restored to mineral entry in February, 1908. The existence of beds of coal which now prove worthy of careful investigation was thus twice overlooked by the government survey.

Confident still in the likelihood of the existence of workable coal in the basin, Mr. Anderson after leaving the government employ devoted considerable time during the next three years to a search for the seams in place. Early in 1912 the reported survey of a railroad in the vicinity revived interest in the Basin and a prospecting party of five persons was sent into the field backed by business men of Grants Pass. The 7-foot vein near the center of the basin on the east fork of Squaw Creek was the first discovery made. Two weeks later and after assiduous search what appeared to be a second much heavier seam is said to have been found a short distance down this stream from the first discovery. No outcrops of this second vein were seen by the writer.

The coal showings found by this party throughout the basin were such that between July thirtieth and October thirtieth, 1912, filings of one hundred sixty acres each were made by ten different persons, and one of six hundred forty acres by an association of four persons. On account of the land being unsurveyed these filings were made in the county land office at Coquille, Oregon, the county seat of Coos county.

In October, 1912, Mr. M. R. Campbell, who has charge of the coal investigations for the U. S. Geological Survey, and Professor Roberts of the University of Washington, visited the basin by request of some of the claimants. As a result of their examination the township was again withdrawn from entry, October 22, 1912, to await classification as to its mineral character. During July, and August, 1913, C. F. Leshar of the United States Geological Survey, accompanied at intervals by representatives of the General Land Office and of the Forest Service spent one week in the Squaw Basin. Mr. Leshar's investigations were made for the purpose of

establishing the coal or non-coal character of the land and its proper valuation. The present report by the Oregon Bureau of Mines and Geology is therefore the first discussion of this district to be presented to the people of the state.

Application for a land survey was made to the proper Federal authorities October first, 1912. About one year later, viz., in September the present year, the survey was authorized. The work will be done by the Surveyor General's office in Portland but will not be begun before the next field season.

CHARACTER OF THE COUNTRY.

The topography of the basin is decidedly rugged. From the south rim whose highest points reach upwards of 3500 feet in altitude and culminate in Bald Knob to the southwest which rises to 3614 feet, the surface drops steeply in a distance of barely over two miles to the South Coquille whose elevation at the lower falls is approximately 1500 feet. This is a fall of in round numbers 1000 feet to the mile, the slope being a general one to the north and in the direction of the dip of the rock strata.

The basin is drained by Squaw creek from which it takes its name, and Fall creek with its main branches, Counts and Donnell creeks, and their tributaries. The east branch of Squaw creek, as also Fall creek and its confluents, assume a general northwesterly course, at times running practically along the strike of the underlying strata, but as a rule cutting across them at a low angle. The west fork of the Squaw flows down the dip of the rock strata nearly due north until within a half mile of its mouth where it veers slightly to the west of north and drops in the neighborhood of 160 feet over the outcropping edges of the two heavy beds of sandstone and intervening shale that appear to mark the base of the coal bearing formation, before making its embouchure into the South Fork of the Coquille river. Fall creek, and the parent Coquille itself, likewise pass over this same sandstone in a series of vertical plunges, all three falls being within a distance of about one-half mile.

Most of the streams in the basin have cut deep sharp gorges and this is especially noticeable in the case of those following the strike, the more abrupt wall being produced to the right, or in the direction of the dip of the beds. A conspicuous example of this tendency is to be observed along the upper course of Fall creek where a vertical cliff of sandstone and conglomerate parallels the stream for more

than a mile before this creek makes the abrupt turn to the north to join the South Coquille. This wall rises a few hundred feet above Fall creek and is so precipitous as to be impregnable except at one or two points. It is locally referred to as the "rim" of the basin.

Despite, however, the vigorous work of the streams and the general ruggedness of the country, all of the slopes are thoroughly covered with loose rock debris and, as a rule, a deep layer of humus soil. Upon this soil is the characteristic abundant vegetation to which the moist climate of the coast slope gives rise, and overshadowing all stands the splendid forest of red and Port Orford cedar, fir and hemlock.

No established trail at present enters the Squaw Basin. It is about thirty-five miles from the Southern Pacific railroad at West Fork in Douglas county. From the east the basin may be reached by taking the West Fork trail to Ash Swamp and from this point the Clay Hill trail to the summit of the divide which forms its south rim. From the west the Myrtle Point-Rogue river trail passes close to the west boundary of the basin. The United States Forest Service has recently recognized the importance of opening up a trail into this section and a moderate appropriation has been made to be used in cooperation with several of the coal claimants for the construction of a horse trail into the field the present winter. The location of this new trail is indicated on the map. It is to be a branch from the "rim" trail and will extend down the South Coquille to near the upper falls where it passes into the basin. Extensions will be made to the most important tunnels. Two well-built cabins now exist in the basin. One of these is centrally located near the forks of Squaw creek on the M. J. Anderson claim. The second, but recently completed, stands at the base of the high sandstone conglomerate cliff which constitutes the northeast wall of the basin, where the new trail comes down into the gorge of Fall creek.

GEOLOGY OF THE BASIN.

As noted earlier, our region is situated just within the eastern border of the area covered by J. S. Diller in the Port Orford folio issued by the United States Geological Survey in 1903. In this publication Diller shows a broad belt of Eocene beds along the whole of the eastern border of the quadrangle. The Squaw Basin lies in this belt and according to this author its rocks constitute a por-

tion of the Arago formation, so termed from the more extensive development of equivalent beds of this period in the Coos Bay quadrangle to the north.

The rocks are heavy-bedded yellow and gray sandstones, blue, gray, and greenish shales, conglomerates, and interspersed coal seams. The sandstones are commonly micaceous and in general coarse-grained, very often carrying numerous siliceous pebbles and frequently passing locally into typical conglomerate. This conglomeratic tendency of the sandstones is a notable feature in essentially all exposures. The shales are commonly sandy and hard as a rule. They break irregularly where unweathered, possess no pronounced cleavage and frequently weather out in a nodular or spheroidal manner and in large rounded boulders which part in concentric shells when shattered. Similar boulders in the sandstones are also a common feature. Shales and sandstones are frequently found grading into each other.

The conglomerates are typically made up of large and small thoroughly rounded igneous and siliceous pebbles firmly bound together by an argillaceous cement impregnated with iron oxide and sometimes silica. In places the pebbles attain the size of boulders. So strongly have these rock fragments been cemented into a solid mass that the conglomerate often stands out in the face of an exposed cliff less affected by weathering than the hard sandstones with which it is associated.

Throughout the Eden Ridge and Squaw Basin region the strata dip at a somewhat varying though comparatively low angle to the east of north. Several measurements in the basin range from eleven to twenty-six degrees in directions varying from N. 29 degrees west to N. 45 degrees east. On account of the universal soil and talus cover and the very few artificial openings, it is impossible to make a sufficient number of observations to determine accurately the attitude in many parts of the basin. Accurate individual readings may still apply over only short distances on account of local changes in the dip, and also because of more recent disturbances, such as creep and land slides, which affect regions of steep slopes, heavy rainfall, and rock strata alternating in character.

Evidence of local disturbance is seen in the shattered condition of the coal wherever it is encountered in place. Both the coal and the hard shale, and even the sandstones, are markedly slickensided in places. Evidence of broader movements is to be observed in



Coal seam in Donnell tunnel, Squaw Basin, Coos County Oregon. Only five feet of coal in a bed of much greater thickness is in view in this tunnel.

the series of faults which strike in an east-west direction across the course of the South Coquille river and through Eden Ridge some distance outside of our present area. A major fault crosses the river near the center of section thirty-three in township thirty-two along which there has been a down-throw at the south of approximately 500 feet. This break is known to extend westward through Eden Ridge where a movement about equal in amount has taken place in the opposite direction, the down-throw side being to the north of the plane of movement. So far as has been observed, the Squaw Basin beds dip continuously to the northward until broken by the fault just described.

A study of the rock strata within the basin and around its borders reveals two especially conspicuous horizons. First, a heavy bed of hard conglomerate which appears typically developed beneath the sandstone capping in the ridge north of Fall Creek. This conglomerate averages forty feet in thickness. The South Coquille passes across it about one mile south of its point of entrance from the adjoining township where the rock is responsible for the upper falls in this river. The same continuous bed may be traced from this point round the south and west slopes of Eden Ridge to beyond the fault referred to along which it has suffered a broad displacement.

A second well-marked horizon is comprised in the two massive beds of sandstone, separated by ten to fifteen feet of shale, that produce the lower and main falls in the South Fork of the Coquille river. The upper of these is estimated at approximately fifty feet and the lower about 100 feet in thickness. These beds of sandstone likewise extend into Eden Ridge where they are a prominent salient in the Ridge slope as viewed from the Squaw Basin.

Calculations from aneroid measurements and dip and strike observations establish with approximate accuracy a stratigraphic thickness of somewhat better than 800 feet of alternating shales and sandstones between these two formations. Above the conglomerate the strata composing Eden Ridge and the coal seams of the Eden Ridge field appear successively. Below it, and largely obscured are the Squaw Basin beds. These two horizons, the heavy sandstone at the base and the conglomerate above, are regarded as marking the limits between which the Squaw Basin coal occurs.

While it is beyond the boundaries of the basin proper, more and better exposures of the rocks which presumably underlie it may be studied on the Rogue river side of the divide. The canon wall drops

precipitously in a series of benches in which some of the beds, whose presence is recognized in the basin beyond can with reasonable certainty be identified.

Two heavy beds of sandstone with interbedded shale which appear to be the equivalent of those just described here occur 900 feet below the crest of the divide. The fact that these sandstones can be seen extending continuously for several miles along the west side of Eden Ridge shows their persistence and lends weight to this tentative correlation. Portions of the slope are obscured by talus but below the massive sandstone whose vertical cliffs are especially conspicuous near the top of the section over 600 feet of alternating shales, sandstones and some conglomerate can be made out. Shales appear to predominate over the sandstones very largely in the section. A fifteen foot bed of loosely aggregated conglomerate occurs about 150 feet below the foot of the upper sandstone cliff. This appears to be the equivalent of a similar bed outcropping near the head of the west branch of Squaw creek. The one-hundred fifty feet above this conglomerate is largely shales and contains what at the surface appear to be two seams of coal.

The upper seam is in view at intervals for a few hundred yards along the slope, at a point beyond the divide about due south of the center of the basin. The slope is very steep and largely free from talus materials. The coal has a position approximately fifty feet below the base of the sandstone cliff, and is eight feet in thickness. The nature of both the coal and the enclosing shale is largely disguised right at the surface but the effects of weathering disappear with surprising rapidity as the bed is opened up. A channel was made across the seam to the depth of one foot. At this depth the coal becomes somewhat harder, brittle and jointy, but apparently quite free from bone and other foreign matter. A two to three-inch light clay parting occurs near the center of the seam. In places a few inches of highly carbonaceous or coaly shale was observed resting directly on top of the coal. The bed dips into the hill at an angle of about twelve degrees and strikes north sixty-five degrees east. A few pieces of clean lump coal were taken from different positions in the seam for determining its quality.

One hundred feet below the wall of sandstone a twelve foot bed of coaly material outcrops. The whole face is badly ironstained and weathered. The upper three feet of this bed is bony coal. The remainder of it appears to be a carbonaceous shale, coaly in

portions. The exact nature of the stratum is in question as it was not opened up to sufficient depth to determine its character where fresh.

These two beds, one eight feet thick and undoubtedly coal, the other exhibiting some of the properties of a weathered coal outcrop, were observed at points a few hundred yards apart. Loose coal from the upper seam was found in the slope directly above the exposure of the lower bed, however. That fact along with their position in relation to the sandstone precludes question as to the existence of both.

The top of the ridge rises over 300 feet above these coal outcrops, the upper beds comprising the heavy bedded sandstones referred to and on top of it shales and shaly sandstones. Blocks of conglomerate and many rounded pebbles high up on the crest are also in evidence.

It may be pointed out again, therefore, that on the Rogue River side of the divide there are exposed 900 feet of strata all of which, if our identification of the "falls" sandstone is correct, are represented in the Squaw Basin. In this section the hard conglomerate which marks the northeast rim of the basin does not appear, unless perchance a bare disintegrating remnant of this ancient boulder bed may still rest in places upon the summit of the divide, which hems in the basin at the south. It is to be noted also that the coal seen on the Rogue river side lies about 600 feet above the basement sandstone.

OCCURRENCE OF THE COAL.

Knowledge concerning the occurrence, character, and extent of the coal of the Squaw Basin has been gained entirely by the finding of drift coal in the stream channels, by an occasional exposure of the coal in place where the streams have cut through it, and in two of the tunnels now being driven by claimants in process of development and proof. Natural outcrops are rare and on account of the newness of the region artificial openings showing the coal are very few. All told, there are not more than a half dozen places within the limits of the entire field where the coal has been observed undisturbed. Float coal is found at intervals along the headstreams and upper courses of the principal streams of the basin. At times it is possible to determine within narrow limits the source of these coal fragments, but, so far as known coal exposed in stream channels

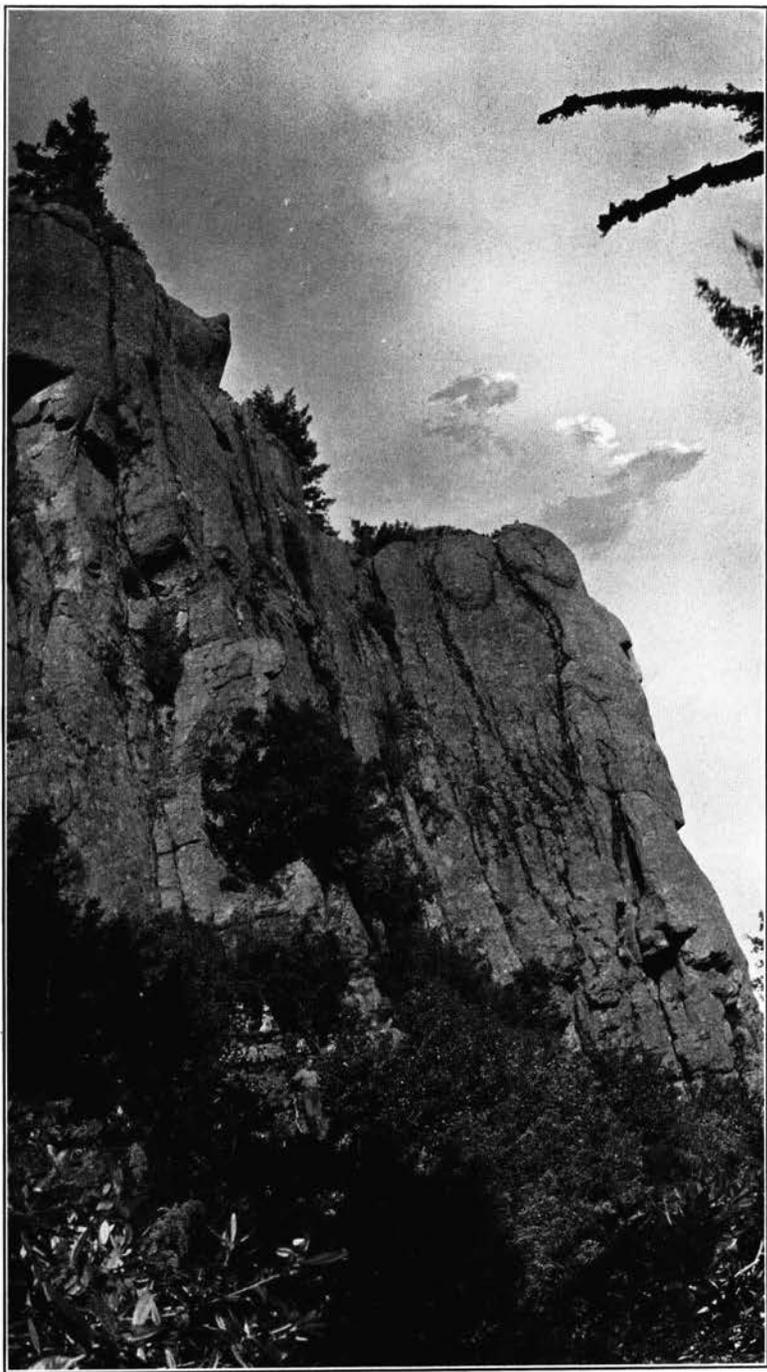
and apparently in place has been found only at the points heretofore mentioned.

Loose pieces of coal are found in the west branch of Squaw creek near its head, and it is to be noted too that traces of a loosely aggregated conglomerate resembling that found on the Rogue river side are also in evidence here. The attitude of the rocks at this point is such as to suggest the probability of this being the same bed. Along the east fork of the Squaw and branches coal is also found at nearly all points above its union with the West Fork. As indicated on the map, a number of prospect tunnels are located along this branch, and on it was made one of the first discoveries of the coal in place. On Fall creek float coal is found to within a few hundred yards of its mouth. Farther up Fall creek and along its branches Counts and Donnell creeks, loose coal occasionally appears.

The finding of lumps of coal in the stream beds is not to be taken as unquestionably indicating close proximity to a coal seam. Pieces of coal move more rapidly down stream on account of their low specific gravity than do pebbles and boulders of other rocks. On the other hand coals are much softer than most other rocks and as a rule tend to slake and crumble when exposed, especially to wetting and drying. Lightness in weight favors rapid movement by flowing water. At the same time softness and friability favor rapid pulverization and destruction of the identity of loose pieces of coal.

On the whole, therefore, the presence of coal fragments of any size in a stream bed is apt to indicate nearness to a coal seam. But confusion will be less likely to ensue if it is remembered that these fragments have moved down the course of the stream and that, therefore, their source is to be sought near where they cease, if followed upstream. Drift coal in the hillside talus, especially if observed contemporaneously with stream float, is an important aid in locating the source of supply. It too, it is to be recalled, has moved only down the slope from the parent bed. In any case the physical nature of the coal should be carefully observed as giving a clue to whether the distance through which it has been transported has probably been great or small.

But two of the tunnels have opened up the coal so that its character may be studied. These will be referred to as the Donnell and the Association tunnels, the former being on Mr. G. W. Donnell's claim near the east edge of the basin and the latter on a branch of Squaw creek near the center of the basin.



Sandstone Cliff, Rogue River Side of Divide, Curry County, Oregon. Fifty Feet
Below its Base an Eight Foot Bed of Coal Outcrops.

The Donnell tunnel was first run in near where the exposed seam was originally discovered in the channel of Donnell creek and driven at a low angle with the strike some twenty-five feet to the coal. This entry did not, however, afford a section across the whole vein, the floor of the tunnel coming in above the base of the coal. The roof is a firm shale and the coal dips ten to eleven degrees in a direction, ten degrees east of north. Five feet in actual thickness of the seam are in view as follows:

	Ft.	In.
a. Roof of firm bluish shale		
b. Coal, brittle and shattered by movement, containing some bone.....	2	6
c. Hard clay parting.....	0	3
d. Coal, firm and jointy, slightly bony.....	2	4

It is reported that test holes in the coal at this point prove the seam to be at least ten feet thick. A sample for analysis was carefully taken from the face excluding the three-inch parting.

A second tunnel is being run at a point twenty-five feet lower and one hundred feet due northwest from the first, with the intent of encountering the vein on the strike. It is now in fifty feet through bouldery clay carrying many pieces of the coal and streaks of coaly matter, but has not yet reached the coal itself. An approximate traverse between these tunnels indicates that by continuing the lower one until the undisturbed shale of the floor is reached, a rise of a few feet should in all probability find the coal in place.

The second and only other tunnel in the district in which to date coal in place has been penetrated is likewise on the site of an original discovery in the channel of the east fork of Squaw creek on the only Association claim in the district.

This tunnel starts at the level of the stream bed and has been driven about thirty feet, the last fifteen of which are in the coal. The bed is cut across the strike and the coal has a sharp dip of twenty-six degrees in a direction ten degrees west of north. The seam has a thickness of seven feet and is known as the "7-foot vein". At present but about five feet are in view from which a sample could be secured. The section is

	Ft.	In.
Shale capping.....		
Brittle and shattered coal with little bone.....	3	0
Shale parting.....	0	3
Clean coal, less broken, more compact and firm below.....	2	0

The results of the analysis and calorimetric test of the coal from this tunnel are given on page 42.

Upon practically all of the eleven claims in the basin, some work has been carried on towards establishing the presence and character of the coal. On the M. J. Anderson claim across which the east fork of Squaw creek also passes, a tunnel has been driven forty feet through loose bouldery clay containing masses of broken coal. A prospect tunnel located on a branch of Counts creek on the claim of C. R. Count has progressed some distance, approximately in the direction of the strike of the rock, finding much crushed coal in the slope debris but as yet no coal in place. On the H. B. Hillis claim, a tunnel is started on this same branch at a point about six hundred yards north, seventy degrees west from the C. R. Count tunnel. The Hillis tunnel goes in ten degrees east of south or almost across the average strike. At thirty feet a hard blue shale floor was struck which rises in the direction of the tunnel. Many lumps and masses of crushed coal were found before the shale was reached but the vein itself has not been found. The approximate and relative locations of these tunnels is shown on the accompanying sketch map.

An inspection of the work done to date on the various claims impresses one at once with the fact that only in those cases where the tunnel has been started near to or actually in an outcrop of the coal has the coal in place been found. It is true that none of the tunnels are as yet in a great distance. But where the coal is not in sight and when in the nature of the case it is impossible to make a sufficient number of instrumental measurements to determine the exact position of the bed and distance from a known outcrop, it is apparent that it is little closer than guess-work to start in a tunnel with the expectation of finding the coal within any certain limits. Under a cover of indefinite depth everywhere, the coal may be cut out or a slight change in dips may entail an endless amount of work through surface materials.

Obviously the way to prospect the region is by means of a core drill. Since the immediate object of such prospecting would be to ascertain the presence of the coal in workable beds, in process of establishing a final proof on each claim, its cost may at first seem prohibitive. If it is recalled, however, that a few properly placed drill holes will supply the information that it may require one or more misplaced and necessarily inaccurately driven tunnels on each claim to furnish, the expense of drilling may not be found to compare so unfavorably.

The data obtained by means of the drill are also such as it will be practically necessary to have before any considerable mining or development of the properties can take place and in order that a proper valuation may be put upon them. Drilling, therefore, accomplishes a dual or triple purpose, while a tunnel, which is experimental at best, will under the most favorable conditions, as a rule, serve only as a temporary makeshift. It is a rare occurrence that a more or less random prospect tunnel serves any important use in the later mining of the coal. Cooperation among the coal claimants in the Squaw Basin, it is believed, in prospecting their claims with the core drill will not only be found expeditious and otherwise advantageous to all at the present time; but will prove in the long run a less expensive method of securing essential information about the coal.

CHARACTER OF THE COAL.

Coal samples were taken from both the Donnell and "7-foot" veins. The former was obtained from the Donnell tunnel and the latter from the Association tunnel on the east fork of Squaw creek. In each case a uniform channel was carefully cut across the cleaned face of the coal, the entire cutting being caught on a canvas. This sample of several pounds was crushed and quartered down to about one quart which was then sealed in a moisture tight metal can and taken to the laboratory. The sample from the eight foot outcrop south of the divide was obtained by selecting from the cuttings in a deep channel across the entire vein, pieces of coal as free as possible from oxidation and the foreign clayey matter with which a natural cropping is usually contaminated. It is not, therefore, a thoroughly representative sample of the coal from the vein at this point.

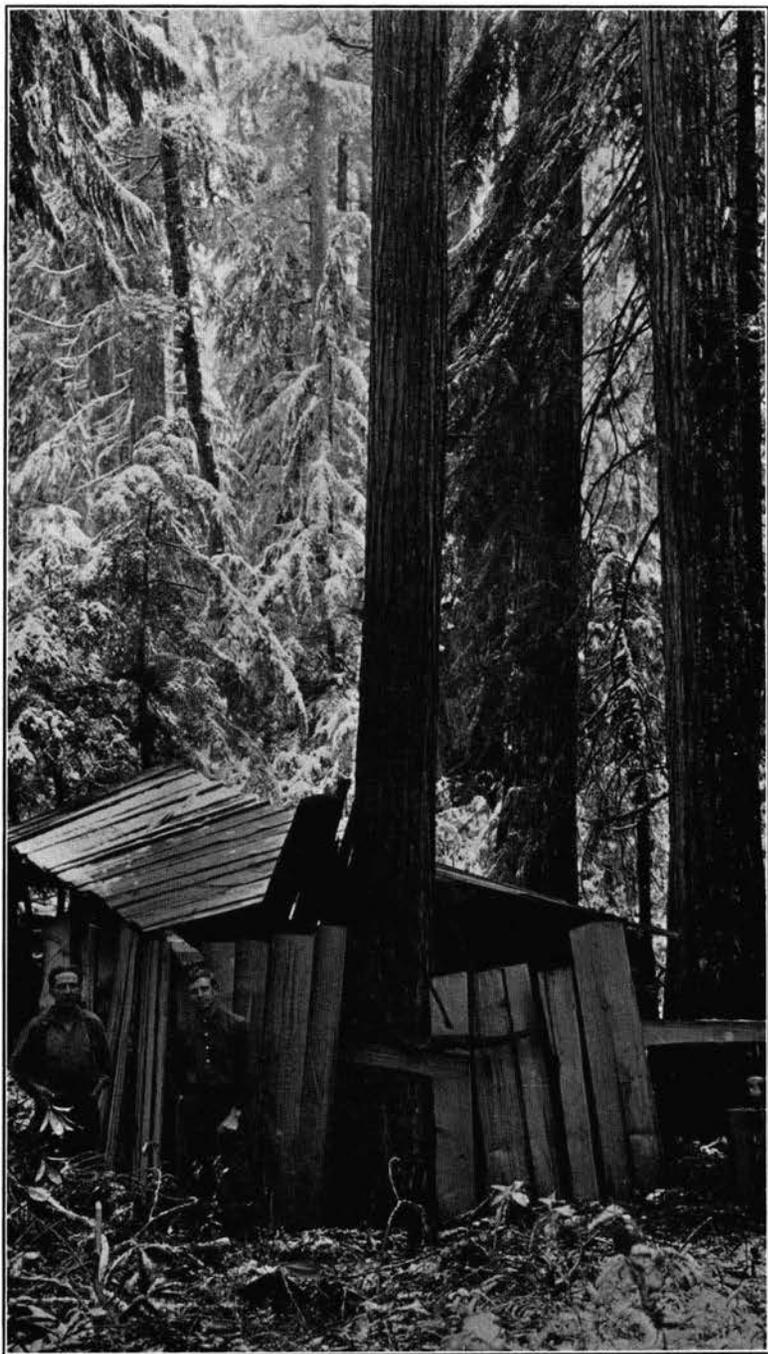
The results of the proximate analyses and calorimetric tests are shown in the accompanying tabulation. There is included also in this table for comparison the analyses and heat values of two samples of coal from the Anderson vein of the Eden Ridge field; two from the Libby mine and one from Beaver Hill both near Marshfield and in Coos County; and lastly, a sample from the Pittsburg bed of Pennsylvania, a well known bituminous coal of standard quality. The analytical and calorimetric work on the first five were done by Mr. S. W. French of the Oregon Bureau of Mines and Geology. The remaining figures were taken from bulletins of the United States Geological Survey, the first two from bulletin No. 431 and the last from No. 332.

ANALYSES OF COAL.

COAL	Total Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur	Air-Drying Loss	Heat Value B. T. U.
Donnell Vein, Squaw Basin.....	11.0	29.5	28.6	30.9	.98	7.4	7670
Donnell Vein—moisture free.....		33.2	32.2	34.6	1.10		8620
Donnell Vein—moisture and ash free.....		50.8	49.2		1.68		13200
Seven Foot Vein, Squaw Basin.....	10.8	35.5	35.7	18.0	1.53	8.2	9550
Seven Foot Vein—moisture free.....		39.7	40.1	20.2	1.72		10700
Seven Foot Vein—moisture and ash free.....		49.7	50.3		2.15		13400
Coal Outcrop, 8 ft. vein S. side of divide.....	12.8	42.8	37.2	7.2		3.5	
Coal Outcrop—moisture free.....		49.1	42.6	8.3			
Coal Outcrop—moisture and ash free.....		53.6	46.4				
Anderson Vein, (above parting) Eden Ridge Field.....	4.6	37.0	36.8	21.6			9600
Anderson Vein—moisture free.....		38.8	38.5	22.7			10070
Anderson Vein—moisture and ash free.....		50.2	49.8				13020
Anderson Vein—(below parting) moisture free.....	5.4	34.0	35.1	25.5			8800
Anderson Vein—moisture and ash free.....		35.9	37.1	27.0			9300
Libby Mine, 3 mi. S. W. of Marshfield.....	24.90	49.2	50.8				12730
Libby Mine—moisture free.....		39.80	27.27	8.03	.75	9.7	8490
Libby Mine—moisture and ash free.....		53.00	36.31	10.69	1.00		11306
Beaver Hill Mine near Marshfield.....	16.10	59.33	40.67		1.12		12659
Beaver Hill Mine—moisture free.....		31.10	39.63	13.17	.81	8.1	9031
Beaver Hill Mine—moisture and ash free.....		37.07	47.23	15.70	.97		10764
Pennsylvania Bituminous Coal, (Pittsburg bed).....	2.01	43.97	56.03		1.15		12769
Pennsylvania Bituminous Coal moisture free.....		33.56	58.11	6.32	1.39		14152
Pennsylvania Bituminous Coal moisture and ash free.....		34.25	59.30	6.45	1.42		14441
Pennsylvania Bituminous Coal moisture and ash free.....		36.61	63.39		1.52		15439

It will be noted that so far as the table shows, the Squaw Basin coals tested fall in the same class with those from the other fields in Coos County. Some variation is found in the quantity of ash among the different coals, also in the ratio of fixed carbon to volatile matter, but these variations are not greater than is to be expected in coals of the same class. The character of the combustible or fuel constituents, that is, fixed carbon and volatile matter is likewise similar, as may be seen by comparing the B. T. U. of the analyses calculated to "moisture and ash free". Neither of these coals exhibit any marked tendency to coke when heated, beyond the slight coherence characteristic of them when heated away from the air.

Both the Donnell coal and the 7-foot vein are deep black in color and when dried out lumps of both appear compact and show no woody structure as does lignite. The Donnell coal shows planes of bedding distinctly. It has no well developed cleavage but breaks more or less irregularly at right angles to the bedding along certain planes of which it separates readily. The coal from the 7-foot vein shows bedding less clearly, has a brighter luster and possesses a



Camp on Donnell Claim, Squaw Basin, Coos County, Oregon.

fairly well-defined cleavage, which may be seen on the surfaces of practically every freshly broken lump. In some ways, therefore, it resembles the better grades of bituminous coal. The streak or color of these coals when powdered is a dark brown, the 7-foot vein coal particularly bordering on black.

The chemical character of these coals, their heat values and their physical properties are such as to place them in the sub-bituminous class, using the terminology adopted by the United States Geological Survey. Sub-bituminous coals are coals intermediate between bituminous and lignite. Since these are all gradations between these extremes it follows that a sub-bituminous coal may be very close in character to either of them. Some of the properties of the coal from the 7-foot vein appear to ally it more closely with the bituminous, while those of the Donnell coal relate it to the lignite end of the series. In an exact determination the manner in which the coals weather is an important factor. Full information on this point is not at present available, but such as is at hand, indicates that, with the foregoing qualifications, both are properly referred to the sub-bituminous variety.

So far little reference has been made to the nature of the coal whose source is said to be a very thick vein somewhat below the 7-foot vein. The finding of a coal-bearing stratum on the south side of the divide about fifty feet lower than the vein which is provisionally regarded as the 7-foot bed is suggestive of the possibility of the occurrence of a similar bed in the basin. Its ultimate importance and much about the character of its coal have yet to be determined.

Pieces of coal believed to have come from a source other than the 7-foot vein are plentiful along Squaw creek. Several lumps were taken from the tunnel dump on the claim of M. J. Anderson. These pieces show bedding plainly but are unusually compact and break with a fracture resembling that of anthracite. They show no cleavage, are hard, and pulverize to a dark brown powder. Fragments from the tunnel and others that had apparently been exposed indefinitely exhibited practically no tendency to slake or crumble by weathering. The average composition of several pieces of this coal is approximately:

Moisture.....	2.53 per cent.
Volatile matter.....	45.08 per cent.
Fixed carbon.....	41.96 per cent.
Ash.....	10.44 per cent.

and its calorific value about 10,800 B. T. U. This coal shows some tendency to coke. Aside from the resistance to weathering and the inclination to coke, the properties of these fragments are such as to refer them likewise to the sub-bituminous class. It is proper to state here, however, that the character of detached pieces of drift coal may be widely different from or closely resemble that of a bed of some depth from which they may have come; the former is the safer assumption until the bed itself is opened up.

NUMBER AND EXTENT OF COAL BEDS.

The position of the Donnell vein with reference to known outcrops of the 7-foot vein leave no question as to their being distinct beds of coal. They are separated by a few hundred feet of sedimentary shales and sandstones and, as the analyses and calorimetric tests show, the coals have characteristic differences. The extent of the Donnell vein it is impossible to predict. Its dip and strike as measured in the Donnell tunnel indicate the improbability of its existence over very much of the area of the basin to the south and west of the Donnell claim. To the north and eastward the inclination is such as to carry it below the rim of the basin and this area should be a promising one to prospect for it.

The relationship within the basin between the 7-foot vein and the reported thicker bed said to be the source of the abundant float found a little below the former is not so clearly made out. The finding of the two beds in the canon south of the main divide, however, in an approximate position to where the projected average dip of the rocks would bring them supports strongly the likelihood of a third vein. But since the only knowledge we have of it comes from one weathered outcropping and from fragments of drift in it, the determination of its exact character must await further development.

It is not possible at the present time to say with certainty much as to the extent of the coal beds of Squaw Basin. This, as has been pointed out, will only be determined by development and the use of the drill. Outside of what little can be seen of the coal itself, there are, nevertheless, certain facts to be observed in the field whose correlation affords a basis for making a general prediction as to number of beds and their continuity. Evidence in this connection may be drawn from two sources, namely the character of the rocks, i. e., their actual physical make-up, and secondly what can be seen of their distribution in this and contiguous areas.

It is to be recalled that the process of coal formation is one of slow accumulation of vegetable matter under swamp conditions. In order that a coal bed of workable thickness can result an amount of plant remains conservatively estimated as at least thirteen times its depth is necessary. A seven foot vein of coal, therefore represents little short of a hundred feet of vegetable materials. To accumulate such a depth, and largely by plant growth in place, would require long periods of time during which the conditions of accumulation did not change very largely. The purer the resulting coal the more constant and unchanging, we conclude, were these conditions and probably the larger the area over which coal-making was going on at the same time.

Lenses or bands of bone or bony coal represent earthy impurities brought in from outside sources and put down with the remains of plant life. A persistent clay parting represents a break in the continuity of vegetable accumulation during which clayey materials were distributed evenly over the swamp area. The presence of these impurities in coal, it may be inferred, therefore, indicate either or both of, small areas of accumulation to all parts of which mineral particles were being constantly carried by moving water, or else, a set of such changeable geologic and climatic conditions that the profuse growth of plants was repeatedly arrested and masses of clayey matter interbedded or intermixed.

Each of the two coal veins in the basin that it is possible to examine have a clay parting of a few inches near the middle. The bone which they contain occurs more largely in hardened clay lenses or nodules than intimately mixed with the coal; a condition by the way, which is favorable to possible purification by washing.

Aside from these facts observable in the coal itself, the accompanying shales and sandstones add their quota of evidence. As already noted, a marked feature of the sandstones is their frequent rapid gradation in coarseness, very commonly passing locally into pebbly conglomerate. Shales likewise become sandy and grade vertically into shaly sandstones.

One deduction from these observations is that during the time the 800 feet or so of strata in the Squaw Basin, including the coal, were being deposited changeable conditions prevailed. Sandstones becoming conglomerate and vice-versa mean varying coast line conditions, elevations and depressions or climatic variations. The intergradation of shales and sandstones indicates changes in ocean

depth. All of which is suggestive of an instability of conditions such as must have obtained when our best grades of coal were forming.

On the other hand, the same region affords much evidence, some in itself positive; that the coal underlies a larger area than might be anticipated from the considerations just given. Judging from its appearance, the results of tests, and its position, there seems little question that the eight foot bed of coal first found by the writer on the south side of the main Rogue-Coquille divide is the extension of the 7-foot vein opened up in the center of the basin. These two localities are about a mile and a quarter apart. The heavy bed containing coaly matter some fifty feet lower down may too, but with less certainty, be correlated with the bed from which much float of distinctive character has been found in the east fork of Squaw creek at an only slightly lower altitude than the outcrop of the 7-foot vein.

Now, the dip of the rock strata from the divide at the south to the South Fork of the Coquille at the north border of the basin is slightly steeper than the average slope of the land surface. A bed of coal exposed at one point would therefore be found, anywhere to the northward, at greater and greater depths below the average surface. The only place at which such a bed could be expected to show at lower altitudes would be in the stream canons on account of their additional depth in the lower parts of their courses. Float coal along the streams in the lowest parts of the basin then is not only not presumptive evidence of additional coal veins but is much more apt to be indicative of a wider extent of veins that may outcrop in other and higher portions of the field.

The finding of loose pieces of coal in many places along the various streams from near the mouth of Fall creek to far up the divide, along with the correlation of actual outcrops noted above strongly suggests the probability that at least the 7-foot bed underlies much of the area of the basin. Even though the variability in character among the enclosing strata is notable, some weight may perhaps be given to this conclusion by the fact, already elsewhere stated, that the coarse conglomerate of the upper falls and the heavy bedded sandstone that marks the base of the Squaw Basin beds can be traced for miles and the latter provisionally recognized south of the divide. These formations, one above and one below, are conformable with the coal bearing beds and represent periods of more or less undisturbed

deposition such as we conceive must obtain in order that any considerable thickness of coal could accumulate.

No systematic search has been made to determine whether the Squaw Basin coal extends across the South Fork of the Coquille river and into Eden Ridge, along the west side of which the falls sandstone and conglomerate may be followed. Between the two falls in this river the rocks are not exposed to such an extent that anything like a complete section can be made out. Similarly, it is not known whether the coal outcrops in the canon of Rock creek just outside of the basin to the west. The stratigraphic position of the coal renders it not improbable that it extends beneath the ridge separating the two streams. Careful examination of these adjacent regions should throw further light upon the question of its probable extent in Squaw Basin.

From the standpoint of market and transportation the Squaw Basin district is at the present time somewhat distant. There is now under construction by the C. A. Smith Lumber Company an extension of the railroad from Marshfield up the South Fork of the Coquille river to a point within about ten miles of the basin. Preliminary surveys have been made on up this river and, just outside the present field, up Rock creek across to the Rogue river side of the divide; also up the South Coquille along the north edge of the field. A railroad from this district would afford an outlet to coast-wise transportation by water from Coos Bay points, for this as well as the contiguous Eden Ridge field.

Should development ultimately prove a considerable extent of the workable beds of coal which present evidence goes to show the existence of in Squaw Basin, this and the adjoining Eden Ridge field will constitute an important source of fuel supply. The Federal government has adopted 8000 B. T. U. as the minimum value of a coal, calculated on the air dry sample, to be considered workable. The heat values of the Squaw Basin coals will, therefore, be taken into consideration along with the other factors, depth, thickness, and accessibility, when its lands are classified. Their heat values as shown will measure well within this limitation. Their thickness where in sight is greater than is worked in many fields. Depth below the surface will necessarily vary widely because of the roughness of the country.

An acre of coal contains about 1800 tons per foot of thickness. A square mile underlain with coal will have about 1,152,000 tons per

foot. A seven-foot vein contains, therefore, in round numbers eight millions of tons. Experience has proved that of this amount but about sixty per cent can be recovered in mining by any room and pillar method. Government valuations of coal land are based on an assumed recovery of that proportion of the coal and range so widely in price per acre according to other factors mentioned that an extended discussion of the details of land classification would be necessary to give an intelligent presentation of the matter.

The entire township in which Squaw Basin is located is now withheld from mineral entry awaiting government classification. Prompt action in placing the proper valuation on the coal lands and throwing them open to purchase is much to be hoped for. Or, in case they do not meet the conditions specified for coal lands, speedy action in restoring them to the public domain is as strongly to be desired.

SOMETHING EVER NEW IN COAL ANNALS.

By IRA A. WILLIAMS.

In no other industry, it is safely said, are men so easily and so frequently misled by the innocent workings of their own minds as in mining. Things and conditions are often interpreted without technical advice, or in spite of it, to meet the especial longings and desires of the individual. It is not rare for a mining proposition based upon such airy foundations to attain a stage of promotion where it attracts the attention of the citizens of a community, oftentimes to their detriment. But it is a less common occurrence in these days for such an Oregon project to gain sufficient impetus, to attract interest and capital from outside states. Whether such a state of affairs has been brought to pass through innocent, ignorant, or sincere representations, or through the exercise of malice, or rascality, it matters not, the reputation of the individual, the community and the state is just as seriously marred when the inevitable collapse comes.

The interests of the Bureau of Mines and Geology are with legitimate development and its aid is extended wherever possible. On the other hand, its sympathies are with the unfortunate person whether misfortune has come through ill-luck, or through being duped into an ill-advised investment; they are with, and its assistance is at every opportunity extended to, the people of a locality that is actually suffering or sees remorse ahead because of the launching of some wildcat scheme or other bottomless enterprise in its midst. In short, the purpose of the Bureau demands that it be fully as zealous in discouraging useless projects as in lending encouragement to those that appear favorable. It is fulfilling one of its largest services to the state of Oregon when it warns against wasteful mining investments, when it presents clearly to the people of a community the exact nature of a questionable enterprise and, doing these, guards the enviable reputation of the state for promoting only what is legitimate and conducive to substantial development.

Intent to defraud, it is refreshing to be able to say, does not always characterize ill-advised mining propositions. Many are gone into in all seriousness and promoted with the confidence borne of a most sincere ignorance. The assumption by those interested

of a knowledge in reality not possessed and especially the serious but floundering effort to apply it to a mining or geologic problem the bearings of which are in no wise fully appreciated is sometimes pathetic if not pitiful. Assistance, not derision, is surely due the deluded ones in a case of this kind.

Among the instances, by no means rare, of the kind just referred to the much heard of coal discovery in Douglas County, east of Roseburg, deserves a frank consideration.

Rumors of a big coal find on the north Umpqua river some thirty-five to forty miles east of Roseburg were rife during the latter part of the summer. In October of this year press reports announced twenty filings in the General Land Office at Roseburg on five association claims of 640 acres each. The records of the land office show that these claims are located within the Umpqua National Forest in township twenty-six south, range one West and that a considerable proportion of the claimants are from some of the middle states.

In the middle of November the writer and Mr. S. W. French, also of the Bureau, were shown pieces of the material said to have come from the "coal" vein and were advised by a Roseburg claimant that a number of men were then at work in the "coal" camp. From the information obtained it seemed advisable that an examination of the region and of the alleged coal deposit be made. Accordingly the Director assigned to Mr. French and the writer this task, and a trip was made to the camp in the closing days of November. The region is reached by mail stage from Roseburg, to Peel, or to Glide, thence on foot or by saddle horse some ten or twelve miles east from Peel or about eighteen miles beyond Glide.

The observations made on this visit were sufficiently convincing so far as the nature and value of the discovery were concerned, but on the solicitation of several of the claimants, the writer two weeks later made a second trip to the region on which a number of additional outcrops were inspected and a larger area of the country covered. Sincere acknowledgement should be made to Mr. George Fair and the other gentlemen at the camp who freely accorded to Mr. French and myself their time and the accommodations of the camp. They are a congenial group of serious minded men of the type that spare no effort to make the visitor welcome.

The country in which the supposed coal occurs is decidedly rugged, with sharp deep canons and high ridges. Many of the latter are flat on top. It lies to the south of the North Umpqua river, between

it and the East Fork of the North Umpqua. The rocks which make up the main ridges and peaks are all volcanic, many of them lavas that have flowed out in the heated and liquid condition, from vents doubtless higher up in the Cascades, and have spread over large areas where they solidified into solid rock.

The appearance and texture of these flow rocks vary widely. In color they range from coal-black through shades of brownish black, brown, pink, greenish and mottled. In practically every case, though a careful examination will show the presence of shiny particles, sometimes light and sometimes dark in color, scattered throughout the rock. These glistening crystals, for such they are, may be so minute as to require a lens to see them, or so large that their shape is easily made out with the naked eye. At times they are so large as to produce a spotted effect. Their number also varies. Sometimes the entire rock seems to be made up of a mass of interlacing crystal particles; in others, they are few and far between, and the body of the rock or matrix in which they are set is glassy or exceedingly fine grained.

Whether a flow rock is crystalline when it cools and becomes solid depends upon several conditions. First, its chemical composition, that is, what it is made of. Some lavas when they come out are very liquid, they are thin and run like water so they spread rapidly over large areas. Other lavas are of such a composition that when highly heated they are thick or viscous and flow slowly like cold molasses and, therefore, unless the quantity is enormously great and the slope steep, do not move as freely or so far as the thin ones.

As soon as the molten lava comes out into contact with the cool atmosphere or with water should the eruption take place, as it frequently does, in the bed of the ocean, it begins to cool, and to harden. Cooling and hardening go on as the lava flows. If the lava is a very highly heated one, it will take longer to cool and to solidify than one already cooler and more viscous at the start. If the lava be very liquid, it likewise, will cool differently from a stiff or thick one. The volume or amount of molten rock in a lava stream and the gases it contains also affect the nature of the resulting solidified rock.

There are, therefore, composition, liquidity, original temperature, slope of the land surface, amount of material and gaseous content all important factors which have determined the character of the volcanic rocks that we find today.

A liquid lava necessarily cools first at the surface, thus producing a solid crust or shell beneath which it is still liquid and the entire stream possibly in motion. The surface of the lava stream, therefore, becomes much broken up by this combination of continued movement and cooling, at the bottom where it is in contact with a cold surface and from above where it is in contact with the atmosphere. But a more interesting effect to us at the present time is that of the rate of cooling on the texture of the rock.

Volcanic rocks are composed of silicates all of which have a strong tendency to form angular crystals in cooling. Under the right conditions of solidification the whole mass will become a network of crystalline minerals. Under unfavorable conditions, practically no crystallization takes place and the rock will be dense and glassy. The most important condition favorable to the formation of crystals is *slow* cooling which means slow solidification; that most favorable for preventing crystal formation is *rapid* cooling, therefore rapid solidification. The outside portions of lava flows have cooled quickly and are as a result often glassy; while the deeper portions have hardened slower and are progressively more and more crystalline the farther in we get from the cooling surface. Some of these silicate minerals possess a stronger tendency or desire to crystallize than do others so we find portions of most every lava flow with some crystals, those minerals with the strongest desire having formed first; and the remainder of the rock remaining stony or glassy. Hence by a close inspection of the volcanic rocks in our present district that have solidified in their present position much can be learned of their early history.

There are associated with the lava type almost always other rocks made up of particles and fragments that have been forcibly ejected from volcanic openings to fall and accumulate in beds of great thickness which were later cemented into solid rock. At times these particles may have fallen into water or have been carried along and distributed to some extent as vast mud streams, which would give to the resulting rock some of the characteristics of a sedimentary rock, though in reality of volcanic origin. The latter are termed volcanic tuff. They, too, are abundant in the region of the "coal" discovery.

At lower altitudes and underlying these undoubted volcanic rocks in this region are true sedimentary strata, shales and sandstone, and occasional seams of lignitic coal. These beds are seen

along the channels of both the North Umpqua and its East Fork and in places in the hills at varying distances above these streams. They are found also locally in between successive beds of volcanic rocks at some points within the area of the coal claims. The rocks of sedimentary origin are readily distinguishable, as a rule, from those of volcanic origin.

The reported coal discovery consists of a bed varying from ten to twelve or fifteen feet in thickness known to underlie a large area of the country in this and adjoining townships. It is found at an altitude of somewhere near 2000 feet above the sea and perhaps 1000 feet above the North Umpqua river. The so-called coal is black, hard, glass-like and most freshly broken surfaces have a dull luster like that of pitch. Scattered through the rock are small white specks, so plenty in places as to give it almost a mottled appearance. These white particles prove, when examined with a lens, to be minute crystals of a silicate mineral, probably feldspar. Wherever observed the entire bed has veins of white quartz running through it. These veins vary from a small fraction to an inch or so in thickness and intersect each other at various angles.

The rock which rests upon the supposed coal as a "cap-rock" or roof is dark colored and shows a decided flow structure. On exposed faces it becomes brown with iron stain and pitted or cavernous by the weathering out of portions of it. The body of the rock is very dense and contains glistening crystals scattered through it. Every feature of this rock shows it to be a volcanic lava, probably andesitic or near basalt in composition. All of the other rocks for a thousand feet above this bed are likewise varieties of volcanic most of which have doubtless reached their present positions by flowing in the molten state out upon the former surface of the land.

Below the alleged coal there are found in places several feet of what appear to be sedimentary beds. These have some of the characteristics of shales and shaly sandstones made up largely of the disintegration fragments of volcanic rocks. Some carbonaceous and even coaly matter is found in these beds, which gives them locally a dark color. At greater depths and at lower altitudes down the mountain slopes other obviously water deposited strata occur at intervals between sheets of volcanic rocks of great thickness.

The occurrence of these apparently sedimentary beds in this position is indeed a misleading circumstance. By the unwary this may be, and has been, accepted as evidence of the sedimentary

nature of the supposed coal bed. The latter is an assumption of no weight, however, for it is not rare at all that volcanic rocks occur in this relationship with sedimentary.

Samples of the rocks that are immediately associated with the supposed coal were taken and have since been carefully studied in the laboratory. The foregoing statements regarding their character are, therefore, made after thoroughly establishing their correctness. The rock which is being called "mineralized" coal and that is being tunneled into with the expectation of its becoming coal was also carefully examined. This rock is properly classified as a variety of volcanic glass closely allied to pitchstone. The only way in which it in the least resembles coal is in its superficial appearance and the splintery and conchoidal way in which pieces of it sometimes break. In no other of its properties does it exhibit any of the characteristics of a coal, nor does it show any evidence of possessing any fuel value whatever. In fact, by one who is familiar with the common types of igneous rocks this volcanic glass is at once recognized.

It is worth while to mention some of the points on which the most insistent arguments as to the great value of this deposit are based. It is held that all the rocks with which the so-called "coal" is associated, both above and below, are sedimentary. This is not true as already explained, and the evidence on this point is so clear that any capable geologist would need only a hand specimen of each rock to establish their true character. The hardness of the "coal" where it is exposed is explained by assuming "mineralization" along the outcrop which is expected to grow less as the rock is penetrated and until finally real coal is reached. This process of mineralization is said to consist of the impregnation of the original coal with mineral compounds deposited by the "hot salt waters" of an ocean warmed to seething heat from volcanic eruptions along its border and presumably in its depths. The carbon of the coal, it is stated, crystallized and exists in that condition, sealed up in a rock mass as hard as flint. These assumptions are absurd ones, so far as our present knowledge goes. Coal becomes softer on exposure to the weather and to moisture, not harder. The present outcrops of the rock have been produced by the tearing down processes of weathering and erosion and there is nothing to indicate that they ever constituted any portion of an ocean shore line. Moreover, ocean water does not carry dissolved in it appreciable quantities of silicate salts and when it deposits such salts as it does contain they are put down as

definite chemical compounds, not as an indefinable and unresolved mixture such as a rock glass is known to be. There is absolutely nothing to indicate the remotest possibility that the nature of this rock will appreciably change either in hardness or composition with increasing depth.

Again, it is insisted that pieces of the rock will burn and give out heat. This is obviously another case where enthusiasm in a cause has enabled a group of otherwise levelheaded men to persuade themselves, and to be persuaded, that something takes place which actually does not. The rock does not burn. It will become red hot in a stove or fireplace as will any other stone, but comes out as it went in unchanged. In a blacksmith's forge, or an assay furnace, it can easily be heated hot enough to melt, in which case it softens, loses its shape, changes its color somewhat, is apt to become quite porous and comes out resembling to some extent the clinker from a furnace using an impure coal. The same can be done with certain other varieties of igneous rocks. But it will be found that, if the rock is weighed before and after heating there will be practically no loss in weight, and what slight loss there is can be shown to be due to the driving out of a few percents of chemically combined water. Emphasis is, therefore, again to be placed upon the fact that the rock does not burn but it will melt.

The clinkery, vesicular nature and the dark color of the interior of pieces of the partially fused rock have given rise to the erroneous conclusion that the "coal" will coke. A prominent characteristic of anthracite coals is the entire absence of coking qualities. The low percentages of volatile matter in hard coal and the higher proportion of fixed carbon renders them a slow burning fuel but one with no coking tendencies whatever.

There are, further, some additional facts which should at least furnish grounds for intelligent thought on the part of every present coal claimant and for hesitation on the part of any one else who might otherwise be inclined to interest himself in the "discovery." First, the position of this bed of rock lying in direct contact with and plainly at times grading into another mass of undoubted volcanic lava is such as to render the occurrence of a uniform vein of coal in that position out of the question. Second, the rock is very much harder than coal, as the operators of the hand drills can testify, and there is no reason to expect it to grow less so. Third, the rock is twice as heavy as coal. No decrease in its weight can be proven

to have taken place in the more than forty feet of tunnel now driven into it, nor can it be expected to change in this respect. Fourth, a complete chemical analysis of it will not show that it contains the minutest fraction of a per cent of combustible fuel matter in any form, and in this respect it has not changed in depth nor are there grounds for believing that it will do so. Fifth, the powdered rock ranges in color from white to gray. This may be seen in the sludge from the drill holes as they are made in driving the tunnel. It can also be tested by scratching a piece with the point of the knife blade and observing the color of the streak that is made. Powdered coal, as every one is aware who has handled it, has, depending on the variety, a dark brown or a perfectly black color. Sixth, and finally, the supreme test and, as a matter of fact, the only test that it should be necessary to apply to determine its fuel value is to burn it. This test has so far failed utterly. Samples from the face of the tunnel offered as showing the most likely resemblance to coal of any obtained were tested with exceeding care to determine this point. The pieces themselves break in a splintery way but show the small white phenocrysts scattered through the mass. They powder gray and when heated to redness and repeatedly weighed until there is no further loss, decrease about five per cent. in weight on account of the combined water this type of rock always contains. Prolonged heating tends only to redden the powder somewhat by the oxidation of the iron to the feric condition.

There are at present (December) in the neighborhood of a dozen men actively engaged in trail building and cabin construction on the different claims, and in pushing forward the main tunnel now in about fifty feet. The filings to date total over 3,000 acres, all of them based on the presence of the same bed of material. Outside of location fees coal-land law requires that each association of four persons expend \$5000 dollars in opening up and improving its claim of not over 640 acres on which entry has been made. There is involved, therefore, in alone the improvement of the five claims twenty-five thousand dollars, besides the time and energy spent in exploiting them. Many of the claimants expressed to the writer a serious determination to liberally spend their time and money with a confidence that success would soon be theirs.

Some detail has been entered into in the foregoing discussion, in order to show that the conclusions given are based upon facts, most of them elementary, which can be observed by anyone who goes into

the field with a mind open to see and to interpret things as they are. The representatives of the Bureau went into this field with minds open and in an unprejudiced way viewed the whole situation. Effort was made while on the ground to point out the many reasons why what may seem to be anthracite coal is in reality volcanic rock. The statement of the matter which precedes is likewise made in the same helpful spirit. Before long the hopelessness of the expenditures now being made will be realized. If this report aids in the slightest to hasten that day its preparation will be thoroughly justified.

What should have been done by the gentlemen interested in this "coal" discovery is to have engaged a thoroughly authorized and competent expert whose report could command confidence to examine the entire region before any coal entries were made. It is also exactly what should now be done before further advancement is made. The money spent in this way would be a mere bagatelle compared with the amount being spent in the present useless labor of finding out for themselves.

It is thoroughly appreciated that the discovery of such a deposit of coal anywhere in Oregon as the present one is reported to be would be of incalculable value. It is likewise apparent that the reaction after the collapse of so to be desired an enterprise will be detrimental to the locality, to Roseburg and to Douglas county in exact proportion to the publicity it has gained, the number of people it has attracted, and the amount of money invested in it. So, in this statement, it is the desire of the Bureau only to present the exact facts in an effort to dissuade the good people who are already on the ground from wasting their time and money, and also, to so place these facts before the public that any further investments in this "coal" discovery may be made with a full knowledge of what the outcome will be.

THE LAW WHICH CREATED THE OREGON BUREAU OF
MINES AND GEOLOGY.

AN ACT

Entitled an Act to establish and create the Bureau to be known as the Oregon Bureau of Mines and Geology, defining its objects, powers and duties; providing for a Commission for the government of the Bureau, defining its powers and duties; providing for the appointment of a director, defining his powers and duties; permitting co-operation with the Federal Bureaus and those of other States in furthering the objects of this Act; providing for the publication of the findings, investigations, reports and statistics compiled by the Bureau; providing for the collection of exhibits of the natural resources of Oregon; authorizing entrance upon private lands in the prosecution of the work of the Bureau; making provision for an appropriation for the enforcement of this Act; and repealing Chapter 227 of the General Laws of Oregon for the year 1911.

BE IT ENACTED BY THE PEOPLE OF THE STATE OF OREGON:

Section 1. That there be and is hereby created and established a bureau to be known as the Oregon Bureau of Mines and Geology.

Section 2. That the said Oregon Bureau of Mines and Geology shall have for its objects and duties the following:

1. A study of the mineral resources of Oregon, with especial reference to their economic products, including coal, oil, gas, ores of the different metals, fertilizers, building stones, road making materials, clays, cement materials, sands, gravels, mineral and artesian waters.

2. A more detailed study of the road making materials of Oregon with reference to their character, distribution and best methods of utilizing the same.

3. An investigation of the clays of Oregon, with reference to their adaptability for the manufacturing of brick, tile, pottery, etc., as well as testing of all the clay manufactured products.

4. An investigation of limestones, shales, clays of Oregon to determine their fitness for use as cement materials.

5. An investigation of fuels of Oregon, including oil, coal and gas with reference to their character, distribution, and methods of utilizing the same.

6. A study of the different ores of Oregon, with especial reference to their conservation, concentration and reduction.

7. The preparation of special reports, with necessary illustrations and maps, which shall contain both general and detailed descriptions of the mineral resources of Oregon.

8. The collection and compilation of statistics of production and consumption of the geologic products in Oregon, with especial reference to the encouragement of new industries.

9. The distribution of suitable specimens of rocks, minerals and materials collected in the work of the Bureau for study and investigation, after they have served the purpose of the Bureau, to such educational institutions and public schools of Oregon as offer instruction in Physiography and Geology.

Section 3. 1. The work of the Bureau is to proceed upon a settled and orderly plan for the benefit of the public and investors and developers in general, but individuals, firms, and corporations may co-operate with the Bureau to further its main purpose which is to increase the mineral production of Oregon rather than to investigate matters of purely scientific interest.

2. An investigation once started by the Bureau as far as practical shall be hastened to completion and its report furnished to the interested public at an early date, and during the progress of these investigations the public shall be kept advised concerning any new facts and important developments.

3. When systematic soil surveys are being made in Oregon, the Bureau may co-operate with the organization having such surveys in charge in obtaining the necessary geological data therefor.

Section 4. 1. The Oregon Bureau of Mines and Geology shall be governed by a Commission which shall be designated as the Commission of the Bureau of Mines and Geology, which is hereby established and shall be composed of seven members as follows: The President of the University of Oregon; the President of the Oregon Agricultural College; and five members to be appointed by the Governor of Oregon, three of whom shall be men thoroughly trained in the technology of one of the geological industries and all five of whom shall be actively engaged therein.

2. The President of the University of Oregon and the President of the Oregon Agricultural College shall be ex officio members of the Commission. The five members appointed by the Governor shall be appointed to serve the balance of the years 1913 and 1914, after this bill goes into effect. This Commission shall meet not later than sixty (60) days after the passage of this Act for the purpose of organizing and carrying out the provisions of this Act.

3. The members of the aforesaid Commission shall serve without compensation but shall be reimbursed for actual expenses incurred in the performance of their official duties. The Commission shall have the general charge of the Bureau and shall appoint a Director qualified to supervise efficiently the work of the Bureau and to carry out the provisions of this Act, and upon his nomination such assistants and employees as the said Commission may deem necessary and the said Commission shall also determine the compensation of all persons employed by the Bureau.

4. The Bureau shall utilize as far as practical the services of geologists and engineers of the Schools of Higher Education in Oregon as well as the equipment of these institutions.

Section 5. That it shall be the duty of the Director of the Bureau to organize and direct the work of the Bureau in field and office, and to determine the order, character and publication of the reports of the Bureau, and to direct the preparation, printing and distribution of the same; to arrange for co-operative work with the various Federal and State Scientific Bureaus, where such work shall redound to the interests of Oregon, and to perform such other work as may be necessary to carry out successfully and speedily the work of the survey; to procure and have charge of the necessary field and office supplies and equipment and to supervise the acquisition, care and distribution of the collections of the Bureau and to perform such other work as may be necessary to the successful conduct of the Bureau. He shall prepare a report to the Legislature before the next regular session of the same, setting forth the progress and condition of the Bureau, together with such other information as may seem necessary and useful.

Section 6. That the Oregon Bureau of Mines and Geology is hereby authorized to enter into co-operation with any Federal or State Scientific Bureau for the prosecution at joint expense of such work in Oregon, as shall be deemed of mutual interest and advantage

and under such conditions as said Bureau deems for the best interests of the people of Oregon.

Section 7. That in order to carry out the provisions of this Act, it shall be lawful for any person employed hereunder, to enter and cross all lands within Oregon; provided, that in so doing no damage is done to private property.

Section 8.

1. The sum of twenty thousand (\$20,000) dollars for the year 1913 and twenty thousand dollars (\$20,000) for the year 1914 is hereby appropriated out of any money in the State Treasury not otherwise appropriated to carry out the provisions of this Act.

2. If the amount available in 1913 for the purposes aforesaid shall not be expended and disbursed during said year, the balance remaining in the State Treasury shall be carried over to the next succeeding year and shall be added to the fund for said succeeding year.

Section 9. The Bureau shall keep its office at the capitol and shall be provided by the Secretary of State with suitable room or rooms, necessary office furniture, supplies, stationery, books, periodicals, maps, and all necessary expenses therefor shall be audited and paid as other state expenses are audited and paid. The Bureau may hold sessions at any place other than the capitol when convenience of the parties so requires. The commissioners, director and such experts as may be employed, shall be entitled to receive out of the appropriation aforesaid their actual necessary expenses while traveling on the business of the Bureau or otherwise carrying out the provisions of this act.

All expenditures shall be verified by the person or persons who incurred the expense and approved by the director of the Bureau.

Section 10. That Chapter 227 of the General Laws of Oregon for the year 1911 be and the same is hereby repealed.

Filed in the office of the Secretary of State, February 28, 1913.

Went into effect June 3, 1913.